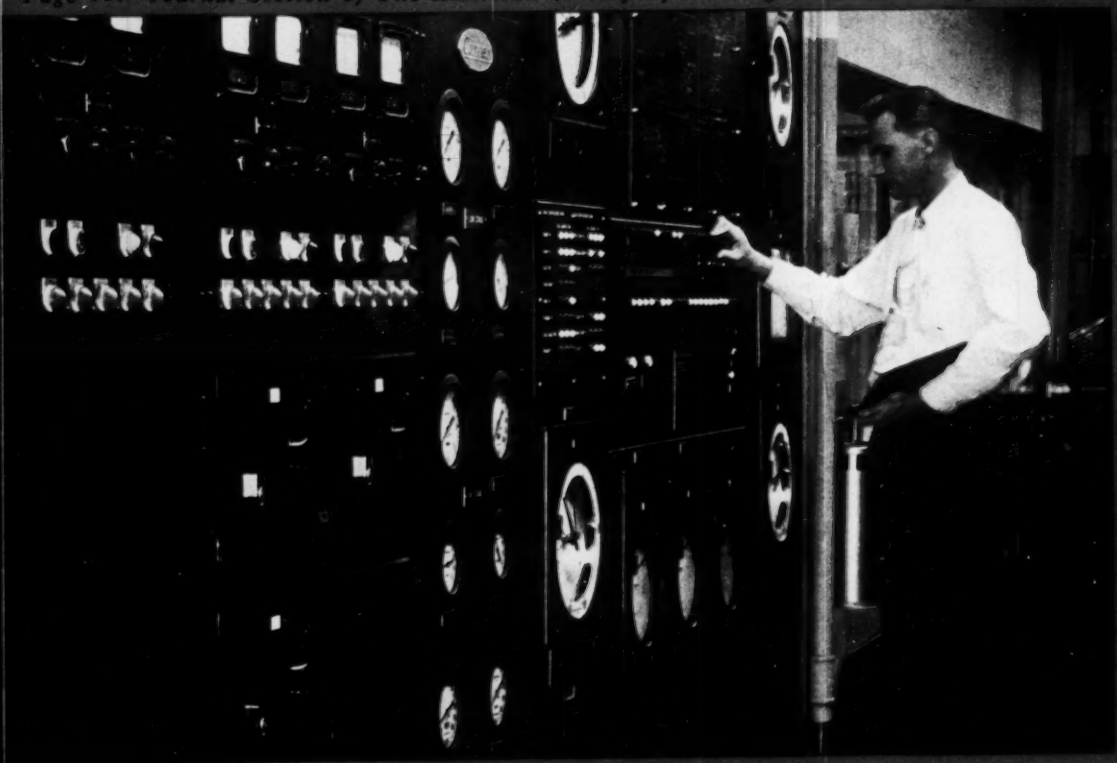
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

JUNE ★ 1951

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 101—Journal Section of The American Society of Heating and Ventilating Engineers



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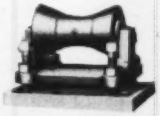
ADJUSTABLE PIPE HANGERS AND SUPPORTS

for every piping requirement

NO. 3 OF A SERIES SHOWING THE GRINNELL LINE

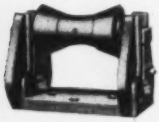
pipe rolls

Pipe Roll and Plate
Fig. 277
2 to 30 in. pipe

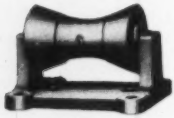


Adj. Pipe Roll with Base
Fig. 274
Without base: Fig. 275
2 to 30 in. pipe

Adj. Swivel Pipe Roll
Fig. 174
2½ to 12 in. pipe



Adj. Pipe Roll
Fig. 276
4 to 30 in. pipe



Pipe Roll Complete
Fig. 271
2 to 30 in. pipe

Single Pipe Roll
Fig. 171
1 to 30 in. pipe

pipe saddles

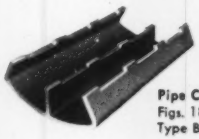
Pipe Stanchion Saddle
Fig. 259
4 to 36 in. pipe

Adj. Pipe Saddle Support
Fig. 264
2½ to 36 in. pipe

Pipe Saddle Support
Fig. 258
4 to 36 in. pipe

Anchor Chair
Fig. 197
4 to 24 in. pipe

Pipe Covering Protection Saddle
Figs. 185, 186, 187, 188
Type A for 10 in. and smaller



Pipe Covering Protection Saddle
Figs. 185, 186, 187, 188
Type B for 12 in. and larger

Write for Hanger Catalog

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WHENEVER PIPING IS INVOLVED

Grinnell Company Inc., Providence, Rhode Island • Sales Offices and Warehouses in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems

Tools of Air Conditioning

JOB IDEAS BY usAIRco

PUZZLE: Find the Star Salesmen in these Stores

FOUR 5-ton usAIRco Store Conditioners are teamed up to handle the entire store conditioning job in the Tri-City Supermarket, North Alton, Ill. Four cooling ducts from the units combine at the rear wall of the main store area into a single 36" x 24" duct running down the center of the market. Air is distributed through 22" ceiling diffusers. Air movements are minimized above frozen food cabinets.

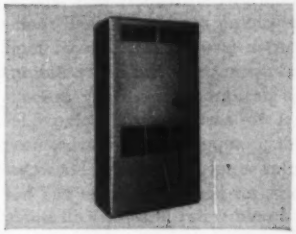
ANSWER

usAIRco STORE CONDITIONER

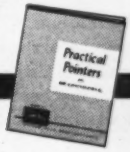
ANSWER usAIRco

UNIT AIR CONDITIONER

INCONSPICUOUS in appearance yet highly potent in results are the usAIRco Unit Air Conditioners in the Henri Bendel Store, 57th Street, New York City. Summer air conditioning stimulates try-ons, reduces soilage, increases sales. Units provide both cooling and dehumidification . . . are designed for easy installation in new or old buildings. Highly adaptable to installations of all kinds.



Units such as shown are teamed up back to back—operate by a mercury switch type multi-step controller to provide just the right amount of summer cooling.



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To ban piping ills here . . . virtually every service is BYERS WROUGHT IRON

One of the most important hospital facilities is the laundry—and because of the number and type of the piping services, careful specification is essential to avoid high maintenance. In this new building, the designers took every precaution to assure long piping life. Steam supply and returns, raw water supply, circulating hot water lines, air lines, soap lines and hot and cold water lines, are all Byers Wrought Iron. Sizes range from ½-in. to 6-in., in both black and galvanized wrought iron pipe.

Maintenance records provide plenty of examples of the consequences of using non-durable materials in these services—and of the wisdom of using wrought iron. In a number of historical instances, wrought iron installed in some of the services mentioned is still on the job after 40 to 50 years of trouble-free performance.

Our booklet, THE A B C's OF WROUGHT IRON digests an interesting story of what wrought iron is, how it is made, why it resists corrosion so well, and where it can be profitably used. May we send you a copy?

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

WHY WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unusual fibrous structure of wrought iron—which is responsible for the unusual corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 23, No. 6

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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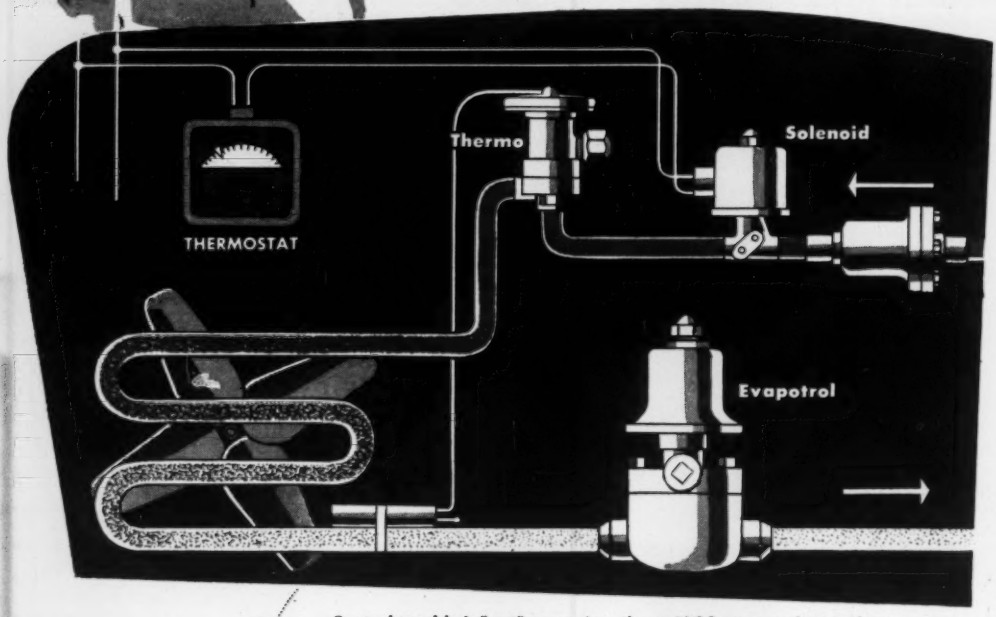

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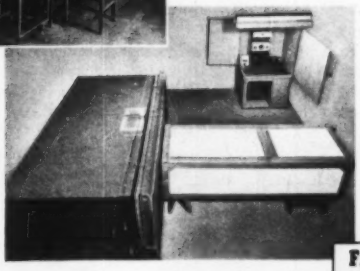

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These laboratory facilities are also used to constantly improve the FAR-AIR line to assure you of getting the very best air filtration when you install FAR-AIR products.

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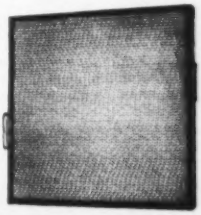

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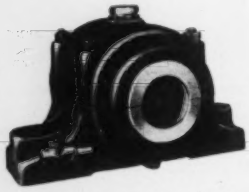
THE MOST COMPLETE LINE FOR FAN AND BLOWER SERVICE



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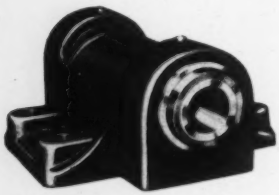
Specially designed for applications where elevated temperatures are encountered. Dodge Sleevoil bearings combine quietness with exceptional load carrying capacity; are available in shaft sizes from 1-11/16" to 8".

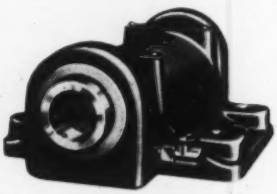
DODGE BRONZOIL

Capillary bronze bushing has capacity of one-third its volume in oil. Reservoir with close fitting wick around bushing provides ample lubrication. Oil resistant grommets available for noise isolation. Sizes 1/2" to 1-1/4".



BALL BEARING PILLOW BLOCK

Single row, deep groove ball bearings. Inner race extended to form sleeve which carries shaft. Piston ring seals retain lubricant, exclude dirt. For arrangement No. 2. Shaft sizes 15/16" to 2-1/4".



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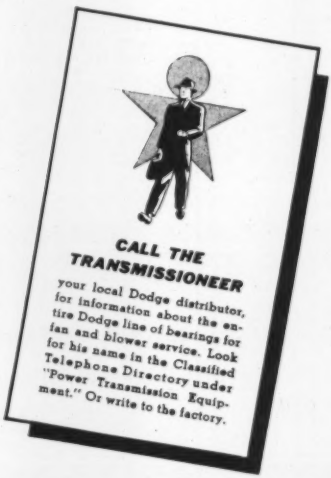
Designed for arrangement No. 2 installations. Two bronze bushings of high lead content and T section rings, sealed against dirt. Composition rings inside thrust collar prevent oil leakage. For shaft sizes 15/16" to 2-3/16".


CALL THE TRANSMISSIONEER
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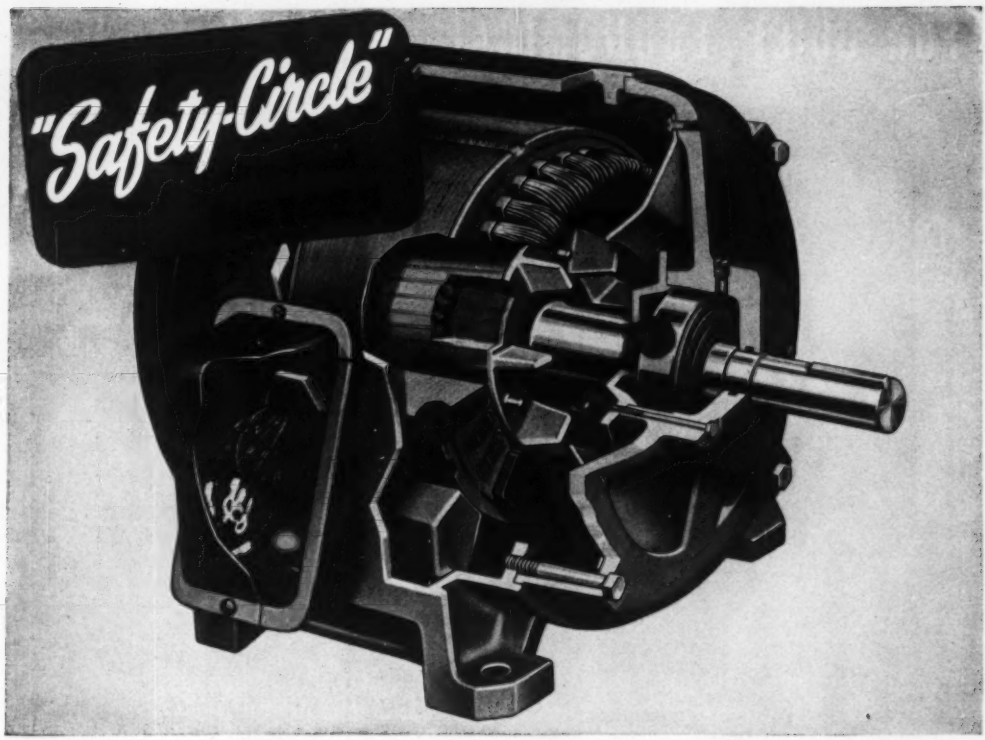

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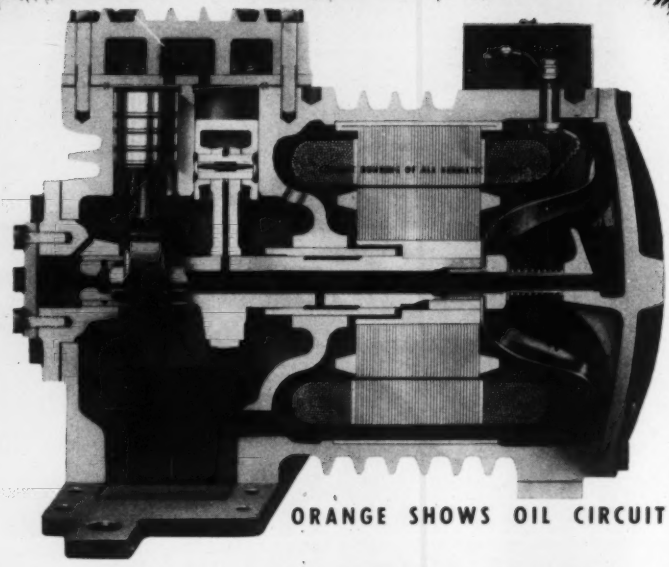

ORANGE SHOWS OIL CIRCUIT

COPELAMETIC

The ACCESSIBLE Hermetic

Smooth, quiet Copelametic gives the greatest value for your air-conditioning dollar. Look over the BTU ratings and you'll see what we mean. Copelametic is the hermetic that combines all the finest features of all types of units. It is field-accessible . . . never a reason to return it to the factory.

Copelametic eliminates belts, seals and manual motor oiling. The cutaway illustration shows how oil reaches all bearing surfaces by forced-feed lubrication. The one-piece compressor and motor housing maintains perfect alignment for bearings and cylinders. Large integral cast fins around the housing dissipate heat rapidly for highest efficiency. In addition, motors are water-cooled above 2 H.P.

Copelametic units can be used on any application now served by open units. Motors for any standard currents. Models from 1/6 H.P. to 7½ H.P., inclusive.

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...improves banking atmosphere

Airmat PL-24 filters provide *clean* air for BANK OF NOVA SCOTIA.

Few people ever see these "*banks* within a bank". The *straight* and *V-bank* installations above show Airmat PL-24 filters collecting atmospheric dust in the Bank of Nova Scotia, Toronto. They furnish clean, filtered air for the extensive air conditioning system servicing both banking floors and offices. Now *clean* air and temperature control make banking hours more pleasant both for customers and employees.

AAF's Airmat PL-24 has proved the most practical and satisfactory *dry* filter ever developed for ventilating and air conditioning service. The efficient and disposable Airmat* media is composed of several plies of tissue-thin, porous sheets . . . made of felted cellulose fibers. The Airmat is held in deep pleats within a specially designed metal cell, which increases effective filtering area to 28 sq. feet in a unit 2′ x 2′ x 8″. Economical maintenance consists of replacing the media. This returns the filter to initial resistance and original condition.

The Airmat PL-24 is widely used in industry as well as in commercial buildings. Its unit construction simplifies installation for any capacity requirements . . . in either *straight* or space-saving *V-bank* arrangements. For full information call your nearest AAF representative or write for Engineering Bulletin No. 230-E.

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Offered in Shell and Coil and Shell and Tube designs, the ACME line of condensers is very complete — more than 120 standard sizes are offered for use with Freon, plus seven sizes in Model SC Shell and Finned Coil, with twelve additional sizes in Model J Shell and Tube Condensers. Both are designed for Freon 12 or Freon 22 Refrigerant. ACME Condensers are inexpensive, have drainable coils, are easy to clean and are compact, sturdily built and extremely efficient.

ACME HEAT EXCHANGERS

Available in 16 standard sizes, in capacities from ½ to 180 tons, ACME Heat Exchangers increase compressor capacity, prevent flash gas in liquid line, eliminate expansion valve vibration or chattering and offer true counter-flow operation. Model H has shell and coil construction. Also available in "U tube" bundle construction. ACME Heat Exchangers offer a practical solution when compressor capacity is on the border line for load requirements.

ACME OIL SEPARATORS

Are offered in a complete range of sizes, are economical and efficient to operate, easy to install and offer positive oil separation. Offered in a complete range of sizes, they are scientifically engineered for use with Ammonia or Freon. Series F Units have a central mounting strap and may be mounted directly on the Compressor base. Series FK and AK Models have a support bracket welded to the top.

ACME DRY-EX* WATER COOLERS

Designed to meet an extensive variety of either commercial or industrial applications, ACME DRY-EX Water Coolers are offered in more than 700 combinations of refrigerant heads baffle spacings and tube lengths. ACME Straight through tube construction permits the refrigerant circuit to be increased twice as frequently as in the "U tube" design. Baffles have a tighter fit with the shell and with the tube, and straight through tubes can easily and economically be replaced in the field.

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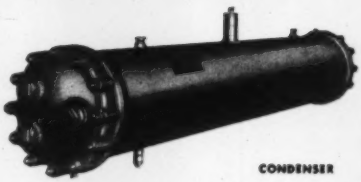
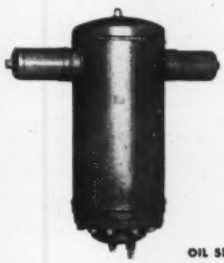
Acme

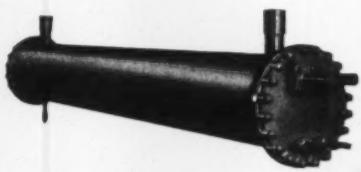


CONDENSER

HEAT EXCHANGER



OIL SEPARATOR



WATER COOLER

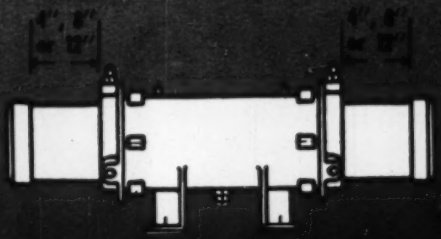
ACME PRODUCTS

*Trade Mark

ACME INDUSTRIES, INC., JACKSON, MICHIGAN, U.S.A.

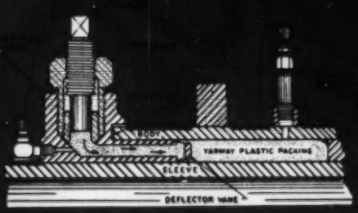
CONTINUOUSLY SERVING THE REFRIGERATION INDUSTRY SINCE 1919

YOU NEED FEWER JOINTS



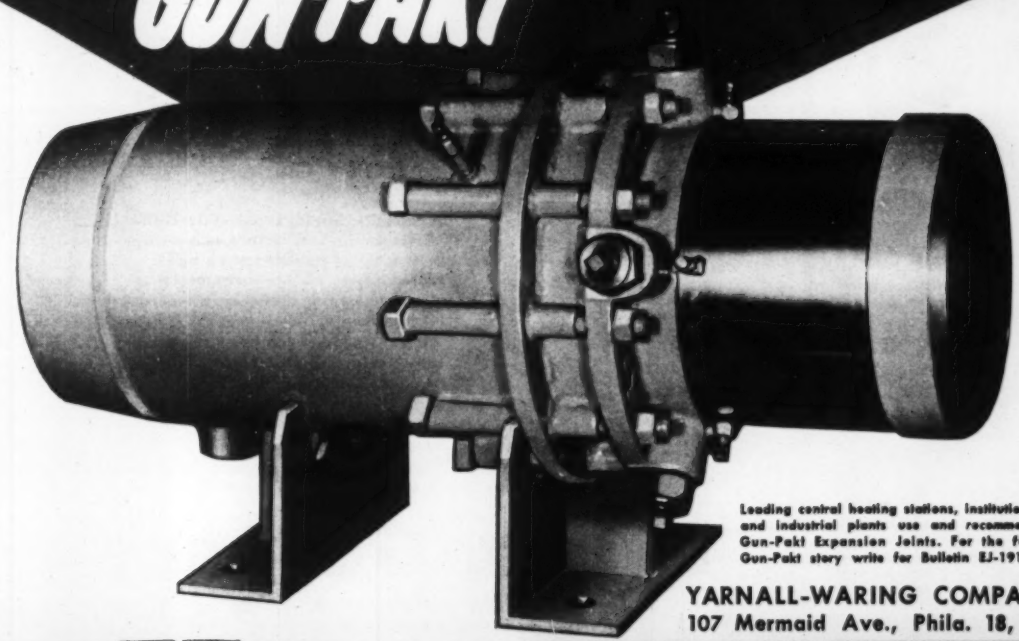
With Yarway Gun-Pakt slip-type expansion joints you need fewer joints than with other types, because each sliding sleeve has a travel of 6", 8" or 12" . . . maximum expansion being 24" for a double-end joint.

For example, one single-end Yarway Gun-Pakt joint with an 8" travel is all that is needed for a 240 ft. run of steel pipe carrying saturated steam at 250 psi.



AND LESS MAINTENANCE

WITH GUN-PAKT EXPANSION JOINTS



Leading central heating stations, institutions and industrial plants use and recommend Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
107 Mermaid Ave., Phila. 18, Pa.

YARWAY GUN-PAKT EXPANSION JOINT

YOU CAN DO A *BETTER* JOB WITH

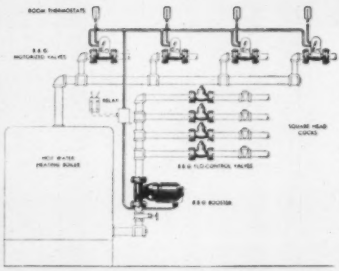
B&G *Hydro-Flo Products protect your most valuable asset — customer satisfaction.*

B & G Booster

B & G Monoflo Fitting

B & G Relief Valve (ASME Stamped)

B & G Deluxe Heater Tankless



Four zone forced hot water heating system with circulation controlled by B & G Motorized Valves and B & G Flo-Control Valves. The B & G Booster starts simultaneously with the opening of any Motorized Valve.

● The quick cleaning design of B & G Flo-Control Valves permits easy removal of dirt which might cause faulty operation—turns a tough job into a simple matter. *No pipe connections to break . . .* merely unscrewing the top cap gives access to the interior of the valve.

B & G Flo-Control Valves give you a choice of either angle or straight patterns, enabling you to meet any piping problem the most convenient way. These valves can be quickly adjusted for automatic or gravity operation by turning the wing nut at the top.

See the B&G catalog for complete size and capacity information. If you haven't a copy, write today.

BELL & GOSSETT
C O M P A N Y

Dept. CB-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada *Reg. U. S. Pat. Off.

FORCED HOT WATER HEATING EQUIPMENT — HEAT EXCHANGERS — WATER HEATERS — PUMPS — REFRIGERATION EQUIPMENT

D. A.*

An HONORARY DEGREE Conferred on

MIDWEST WELDING ELBOWS

By Pipe Welders Everywhere

Pipe welders who know Midwest Welding Elbows have conferred upon them an honorary degree unique in piping . . . "D. A." for "dimensional accuracy".

This degree was earned for Midwest Elbows by their unique process of manufacture. In this process, developed by Midwest, the elbow is first made slightly oversize. After welding it is reheated to forging temperature and brought to final size in compression dies. This relieves forming and welding stress . . . assures true circular cross-section, controlled wall thickness and accurate radius, included arc and tangents. The elbows are beveled on special machines which cut both ends simultaneously, holding exact included angle and center-to-end dimensions.

"D. A." is a degree which means a lot to pipe welders. It means that they don't have to waste time lining up inaccurate fittings. It means that they don't have to spend time and weld metal in compensating for bad fit. And it means that they can produce better, cleaner, stronger welds with less trouble.

"D. A." saves money for you when it saves time and trouble for welders. Use Midwest "D. A." Elbows on your next job. Call your Midwest Distributor; there is one conveniently near you.

MIDWEST PIPING & SUPPLY CO., Inc.

MAIN OFFICES: 1450 SO. SECOND STREET, ST. LOUIS 4, MO.
Sales Offices: New York 7—30 Church St. ● Chicago 3—79 W. Monroe St. ● Los Angeles 33—520 Anderson St. Houston 2—1213 Capitol Ave. ● Tulsa 3—224 Wright Bldg. Boston 27—426 First St.

* Dimensional Accuracy

architect . . Gustave W. Iser

and

engineer . . R. W. Billharz

United on Sarcotherm Modulating Heat Control

To give these outstanding apartments perfect heating comfort under all weather conditions

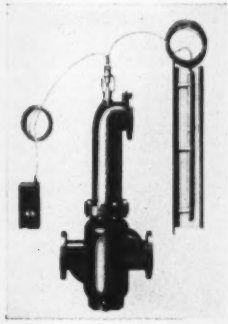
Yes, team work pays! It brings increased efficiency as well as superior design. The addition of Sarcotherm heat control to the combination made sure of owner satisfaction.

Sarcotherm is the simple, mechanical outdoor control, ideal for hot water or radiant heat.

For apartments, hospitals and institutions, it can be made fully automatic by adding the Centralized Program Panel.

Ask a Sarcotherm engineer to see you today. There is one near you. Or write for new bulletin ST-5011.

Typical centralized program panel.



Sarcotherm weather-compensated control valve.

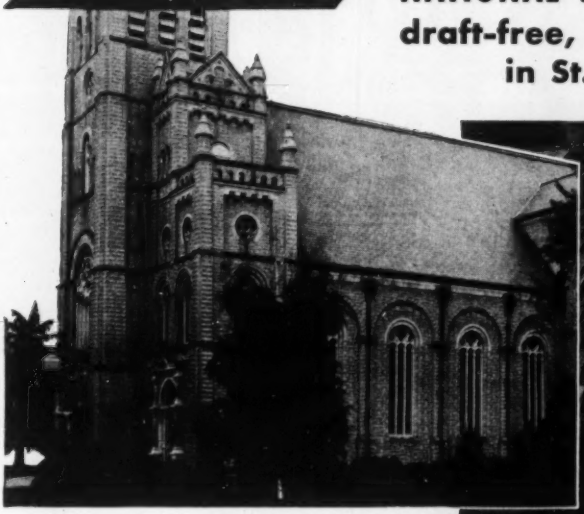
20

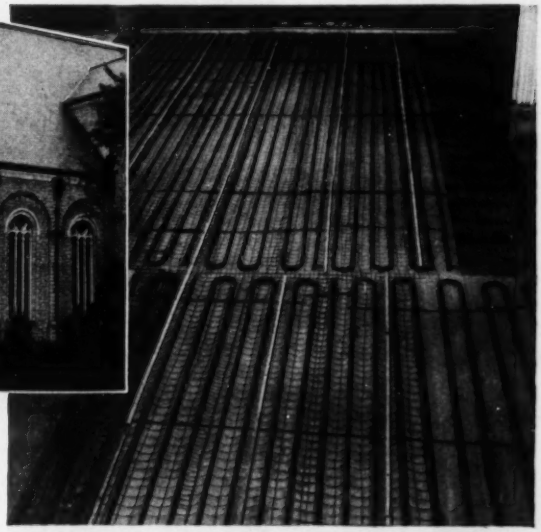
SPECIFY SARCOTHERM
SEE SWEETS CATALOG
SECTION 29E/SA

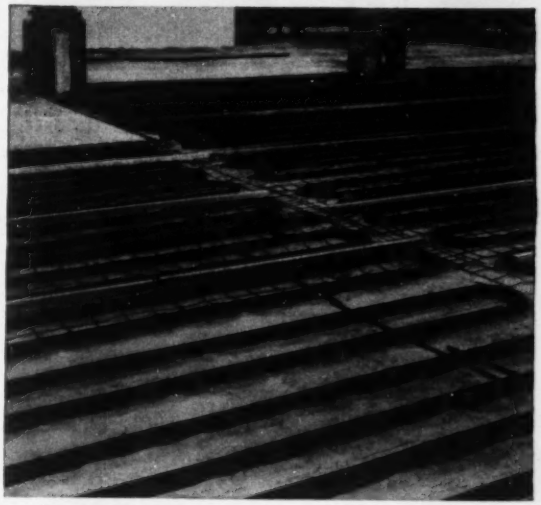
Sarcotherm

SARCOTHERM CONTROLS, INC. • Empire State Bldg. • NEW YORK 1, N. Y.

NOW . . . modern radiant heating with NATIONAL STEEL PIPE assures draft-free, year-round comfort in St. John's Church







ST. JOHN'S CHURCH in Delphos, Ohio, is a good example of a hard-to-heat building made comfortable with radiant heating.

The auditorium in this beautiful old stone church is 135′ x 65′. The vaulted ceiling is over 65′ high. Here was a natural for radiant heating.

To keep installation costs down, the insulating paper was laid right over the old wood floor. Then came ¾″ steel bars. Finally, 10,110 feet of 1¼″ National Steel Pipe was tied to the bars and over this a 2″ layer of concrete was poured.

Now, at last, the floors are warm. The entire auditorium is comfortable. And the room is free from obstructions, hot spots and cold spots.

Why did they use National *Steel* Pipe? For one thing, it's economical in cost . . . it is readily welded, it is strong, yet sufficiently ductile to permit easy bending. But best of all is its record for long life and trouble-free service. It has been standard for conventional hot water heating for over 60 years.

If you are planning a future radiant heating installation for a church, garage, store, terminal, factory, warehouse or plant, remember that National—the world's largest selling pipe—has all the qualities that make for a successful application.

USS

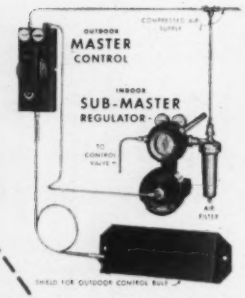
NATIONAL TUBE COMPANY, PITTSBURGH, PA.

COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

NATIONAL Steel PIPE

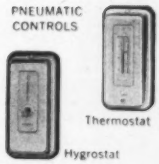
UNITED STATES STEEL

MASTROL SYSTEM for Forced Hot Water Heating



PNEUMATIC CONTROLS

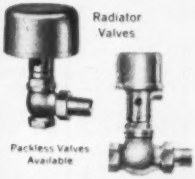
No. 11 Self-Operating Regulators



Thermostat

Hygrostat

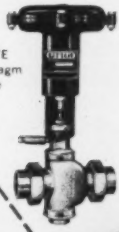
Radiator Valves



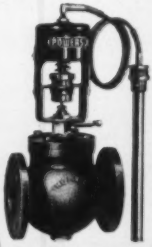
Packless Valves Available

3-Way FLOWRITE Valve

Pneumatic Switches



FLOWRITE Diaphragm Valve



AIRSTREAM Thermostat

POWERSTROKE

Damper Motor

ACCRITEM REGULATOR
Compressed Air or Water Operated

FLOWRITE Valve

METAFLOW Valve Available Packless

POWERS

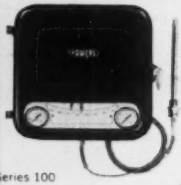
TEMPERATURE and HUMIDITY CONTROL

For Heating and Air Conditioning Systems Industrial Processes

Water Heaters • Heat Exchangers Jacket Water Cooling

All Types of Baths Hospital Hydrotherapy

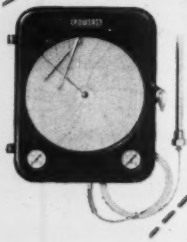
Most of your control problems can be solved successfully with the aid of a POWERS engineer and the proper application of some of our modern products. Why not profit from our 60 years of experience? There's no obligation. Phone or write our nearest office.



Series 100 Pneumatic Indicating Regulator

Pneumatic

Right: Static Pressure Regulator



Left: Series 100 Recording Regulator

Self-Operating

Thermostatic Water Mixers

THE POWERS REGULATOR CO.

Established 1891 • Offices in Over 50 Cities • See Your Phone Book

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LOS ANGELES 5, CALIF. • 1808 West 8th Street
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11 Reasons Why

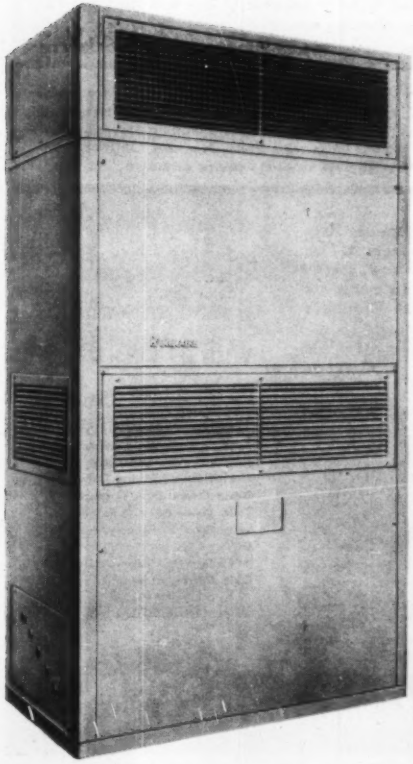
BAKERAIRE'S THE "BUY"!

for Air Conditioning that saves dollars and makes sense!

Air conditioning doesn't *have* to be expensive any longer. The new Bakeraire has been engineered to deliver more cooling per horsepower at lower cost, achieved by Baker design developments. It's more efficient . . . operating time is reduced. It costs less to install . . . with simplified connections. It costs less to operate . . . with a new water-saving condenser.

No matter how you look at it . . . Bakeraire is the "buy" for 1951. Housed in a beautiful new "Kiel" gray finished cabinet . . . 3, 5, 7½ and 10 ton capacities.

Baker Refrigeration Corporation, South Windham, Maine.



1. **Exclusive "Sphericoil"** over-capacity condenser exchanges heat faster with less water consumption.
2. **High capacity fans** provide large volume, draft-free air flow, quietly and efficiently.
3. **5-row cooling coils,** staggered to give maximum air surface exposure, unobstructed air flow.
4. **Humidity control,** reduces air moisture content on muggy days for greater cooling comfort.
5. **Permanent air filters,** crimped wire mesh, easily removed for quick cleaning with steam or hot water.
6. **Fiberglas insulation,** sound absorbent, waterproof, ratproof, does not hold odors, prevents sweating.
7. **Famous Baker Freon** compressor, Timken bearing open-type or hermetic as desired in all capacities.
8. **Reversible plenum,** adjustable for front or rear 4-way air discharge, up and down, left and right.
9. **Easy connecting,** with new 45° plumbing "tree" cuts connecting time 50% to city water or water tower.
10. **Overload protection,** motor starter with automatic overload protection, high-low pressure control.
11. **Coil spring mounting** "cradles" compressor unit to absorb vibration and assure quiet operation.

GET ALL THE FACTS

Call your local Baker Distributor or write today to Baker Refrigeration Corporation, South Windham, Maine, Dept. HP

"Intentionally Better Since 1905"

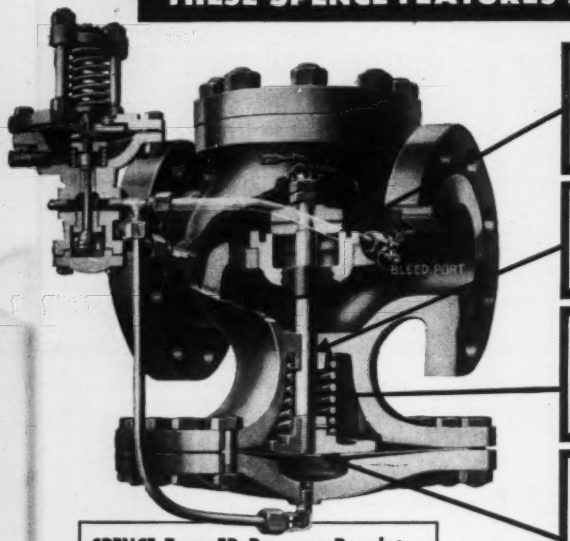
Baker

AIR CONDITIONING and REFRIGERATION

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

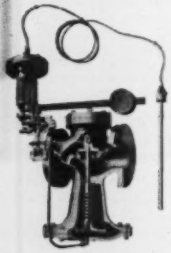
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

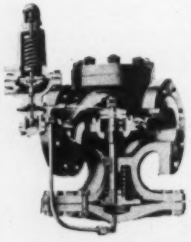
LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

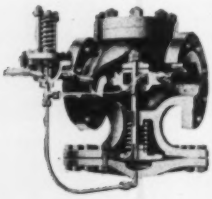
Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.



Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
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General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

BRUNNER SINCE 1906 **REFRIGERATION** helps you serve better

Maybe we can help if you are having trouble finding the units you need!

With 69 different models, types and capacities of refrigeration condensing units being built on regular production schedules in the Brunner plants, you have more assurance of getting exactly what you need, and when you need it, without wasting time hunting.

What's more, we offer you the help of experienced factory field men backed by an able engineering staff who have encountered and answered just about every kind of refrigeration or air conditioning problem imaginable.

With so much to offer folks engaged in the commercial refrigeration business, it just doesn't make sense to deprive yourself of the advantages that come with recommending and installing Brunner's as a regular habit.

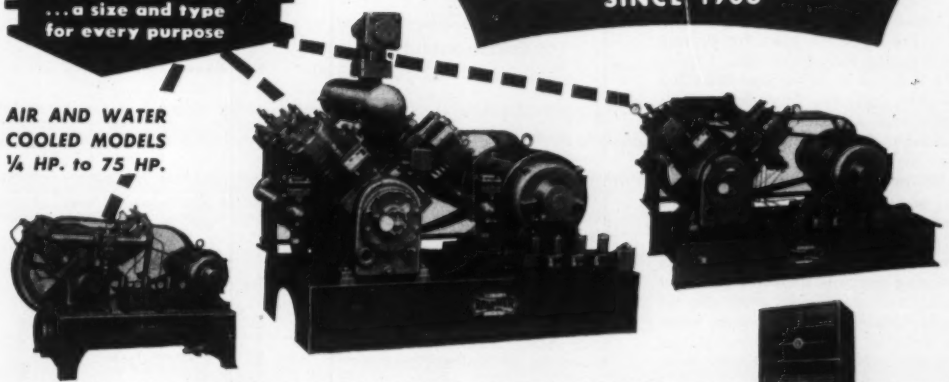
BRUNNER MANUFACTURING COMPANY, UTICA 1, N. Y., U. S. A.

P.S. *As a business man you should talk to a Brunner factory sales engineer. It costs nothing to listen, and you may discover that you have been missing a good bet. Your name and address written on the margin of this ad and mailed to us at Utica is all that is necessary.*

REFRIGERATION CONDENSING UNITS ...a size and type for every purpose

BRUNNER SINCE 1906

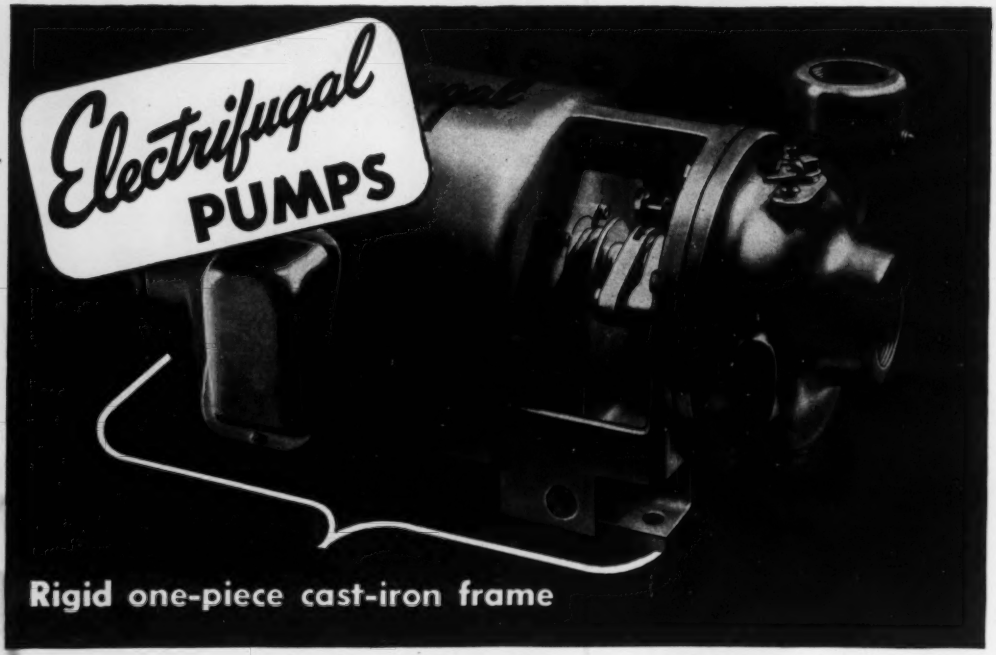
AIR AND WATER COOLED MODELS ¼ HP. to 75 HP.



BRUNNER SINCE 1906

AIR CONDITIONING

Self Contained Units in 4 sizes: 3-5-7½ and 10 HP.
Remote Installation Types from 3 to 75 HP.



This is the difference between close-coupled pumps

THIS EXCLUSIVE FRAME DESIGN combines maximum space for packing maintenance with exceptional rigidity in a way that no pump assembled to a standard motor can do. Solid cast iron frame with no joints from motor end housing to pump casing assures permanent alignment.

Bearings are lubricated at the factory and should require no attention for years. The stuffing box carries plenty of packing and all parts are generously proportioned for heavy duty service. Wearing rings and shaft sleeves protect casing and shaft from wear and are easily replaced at low cost when worn. As a result, you will find exceptional freedom from high maintenance costs.

Unit Responsibility Means Dependability

Motor and pump are designed for each other and made in the same plant. You have one responsible source for both... one guarantee of satisfaction. Every Allis-Chalmers pump representative is a competent application engineer who will help you select exactly the right pump for your needs. And 94 Allis-Chalmers Certified Service Shops provide nation-wide factory approved service.

Talk over your pump selection problems with your Allis-Chalmers Authorized Dealer or Sales Representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 52B6140.

A-3337

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

Electrifugal, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

This door is ALWAYS open

take advantage of Wolverine's open door

You are always welcome here—in our Customer Engineering Service—
where we discuss problems that deal with tubing and its various functions.

There's no point in your struggling with a tubing problem
when you can have the answer so readily here in Customer Engineering service.

The vast experience of more than three decades of
extensive tube making is represented within this department.
And it's all available for you to draw on without cost.

Just because tube is immobile when installed, don't dismiss it
as something that needs no more consideration than that. In its diverse forms
it can serve you efficiently or inefficiently.

The time to think about the specifications of your tube requirements is *before*
you make your installations—before you encounter difficulties—
so you can be sure that the product you are building—that
may require plain or fabricated tube—will function in the highest degree of efficiency.

WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of seamless non-ferrous tubing
1419 CENTRAL AVENUE • DETROIT 9, MICHIGAN

Sales Offices in Principal Cities — *Plants in Detroit, Mich. and Decatur, Ala.*

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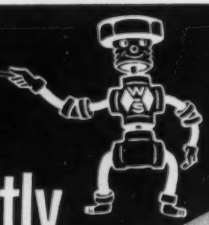
Where pipes meet permanently...



WATSON-STILLMAN

DISTRIBUTOR PRODUCTS DIVISION **WATSON-STILLMAN** ESTABLISHED 1848 • ROSELLE, NEW JERSEY

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

Everything you want IN A COMPLETE LINE OF GENERAL SERVICE END SUCTION PUMPS

THEIR APPLICATION IS GENERAL BUT THEIR RESULTS ARE SPECIFIC

LOW COST: Mass production methods, high volume, modern factory facilities insure a reasonably priced product. Highest quality materials and workmanship, rigid inspection, and proper design insure a superior product at this reasonable price.

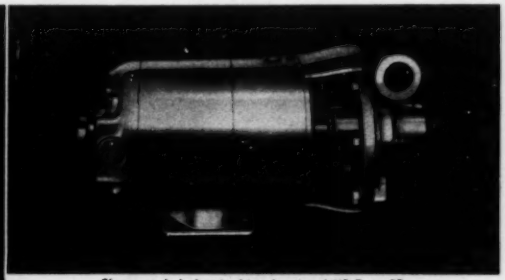
SAVE ON SERVICE: Hydraulic characteristics are superior, insuring lowest operating cost over the longest time. Servicing is held to a minimum due to the inherent features of construction, for example: Fractional sizes furnished standard with mechanical seal; extra wide and deep stuffing box on all integral sizes. Integral sizes available with simple, fool-proof mechanical seal, at slight extra cost.

PEAK PERFORMANCE: The Peerless Fluidyne line was designed with high efficiency in mind. Comparison with other makes will prove that Peerless furnishes peak performance, size for size. Two types, direct-connected electric drive (Type PE) and V- or flat belt pulley or flexible coupled drive (Type PB), meet every installation requirement.

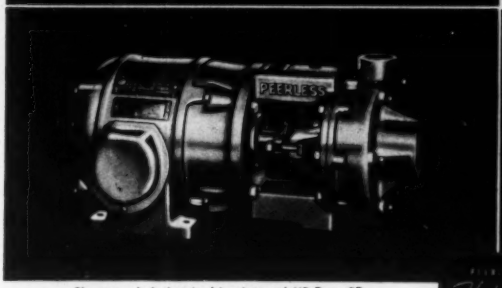
BROADEST RANGE OF SIZES AND CAPACITIES: Peerless manufactures the *complete* line of pumps. Available in all sizes and capacities from ¼ to 150 h.p., 10 to 5500 gpm, and heads to 260 ft. Most sizes and types carried in factory stock, available either from Indianapolis, Indiana or Los Angeles, California.

PEERLESS *Fluidyne* PUMPS

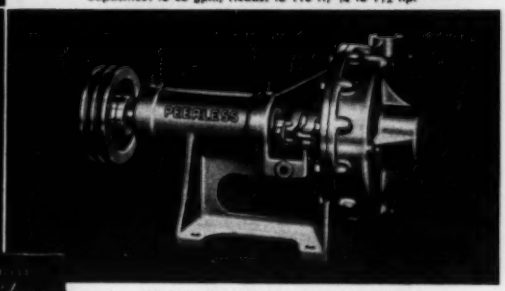
VERSATILE • EFFICIENT • ECONOMICAL



Close-coupled electric drive fractional HP Type PE
Capacities: to 65 gpm; Heads: to 110 ft; ¼ to 1½ hp.



Close-coupled electric drive integral HP Type PE
Capacities: to 1000 gpm; Heads: to 200 ft; up to 60 hp.



V-belt (or flat belt) drive integral HP Type PB
Capacities: to 5500 gpm; Heads: to 260 ft; up to 150 hp.

NEW BULLETIN describes additional features of pumps in the Peerless Fluidyne line. Write for your copy of this 24-page fully illustrated and descriptive engineering bulletin today.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
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Los Angeles 31, California or Indianapolis 8, Indiana
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview, Lubbock, Texas; Albuquerque, New Mexico.

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FOOD MACHINERY AND CHEMICAL CORPORATION
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Please send me a copy of Peerless Fluidyne Pump Bulletin No. B-2300.

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HPAC

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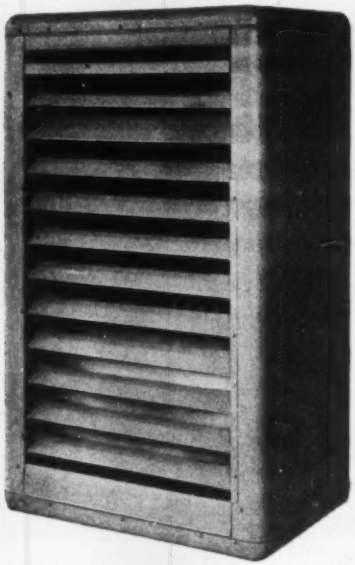
For clean, safe, trouble-free heating of industrial and commercial establishments, gas-fired suspended heaters have proven themselves and assure customer satisfaction. A complete, packaged unit fully automatic, the heaters are suspended from the ceiling to conserve valuable floor space and yet are designed so that they will be an attractive addition to any shop or store.

A.G.A. Approved for Natural, Mixed, Manufactured or LP Gas



UHS MODEL

UH-4 MODEL

Write for Literature

JOHN ZINK COMPANY

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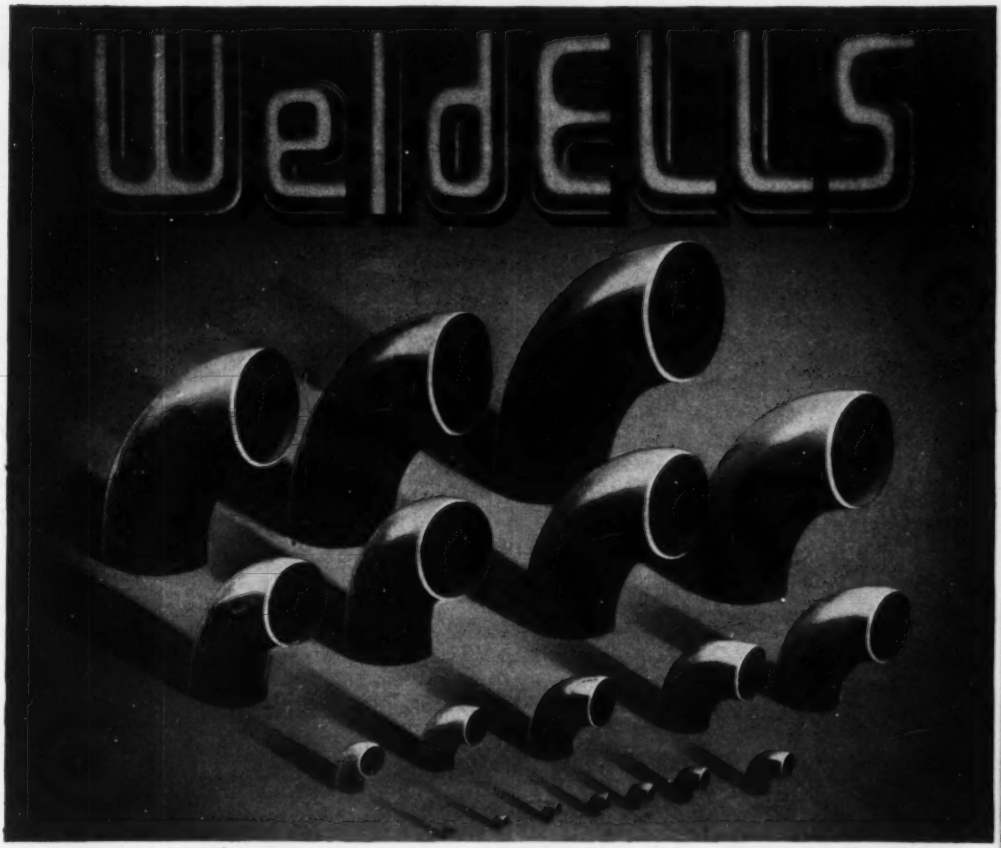

Family Group . . . *proud of its size . . . and traditions*

Large group though it is, you see here only one branch of the world's largest family of fittings for pipe welding.

It is simply the stock sizes of long-radius WeldELLS in a single weight and material — merely a small fraction of the enormous line that includes more types of fittings, in more materials, more weights and more sizes than any other line.

Important though the breadth of the WeldELL line is to every man who designs or erects piping, still more important is the significant fact that the WeldELL family grew to this size because nothing less could meet the demand for fittings of WeldELL quality and uniformity to satisfy every conceivable piping condition.

Yes, there is a Taylor Forge Fitting for every purpose. From the smallest to the largest, every fitting in the WeldELL line shares the principle of sound engineering design and job-speeding utility that Taylor Forge has consistently applied for half a century.

Mail the coupon for Taylor Forge catalog.

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TAYLOR SPIRAL PIPE is available in a broad range of sizes and thicknesses. Coupon brings Spiral Pipe Bulletin 493.

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Offices in all principal cities: *Eastern Plant:* Carnegie, Pa.
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☐ Please send Catalog 484 covering welding fittings and forged steel flanges.
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Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.
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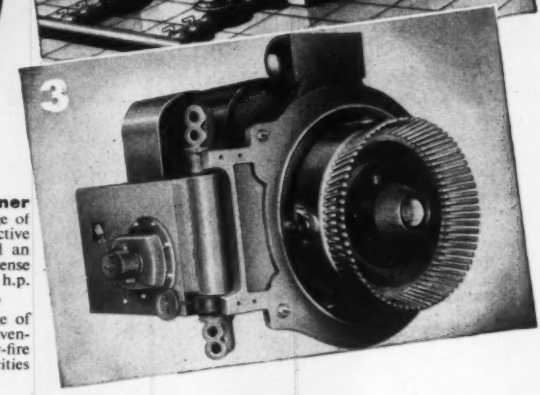
Can you afford to waste what Iron Fireman users are saving?



Install Iron Fireman GAS FIRING

for medium or large heating jobs

1. Iron Fireman Radiant "Inshot" Gas Burner
This low pressure burner has an efficient firing range of 10% to 100% of capacity, making it a particularly effective burner for modulated firing. Opposed gas jets and an improved method of air entrainment produce an intense radiant flame. Capacities range from 6 to 500 boiler h.p.

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This gas burner is readily adaptable to a wide range of firebox dimensions and is easily installed in any conventional boiler setting. Zone fire control permits low-fire start and modulated firing. Low pressure gas. Capacities from 6 to 500 boiler h.p.

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Iron Fireman Ring Type gas burner combined with Iron Fireman Horizontal Rotary oil burner permits quick fuel change to meet sudden emergencies, or avoid interruption during daily or seasonal gas shortages. Can also be combined with Iron Fireman Pneumatic Spreader stoker. Capacities up to 500 boiler h.p.

A heating survey made without cost or obligation to you, will show you what you can save with Iron Fireman gas firing. For such a survey, or descriptive literature, write Iron Fireman Mfg. Co., 3156 W. 106th Street, Cleveland 11, Ohio, or call nearest Iron Fireman dealer.

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AUTOMATIC FIRING EQUIPMENT FOR GAS, OIL, COAL

CUTS DAMAGE AND REPLACEMENT COSTS

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CUSTOMED FOR FACTORY USE AND ABUSE

This grille especially designed for Atomic Energy Commission.

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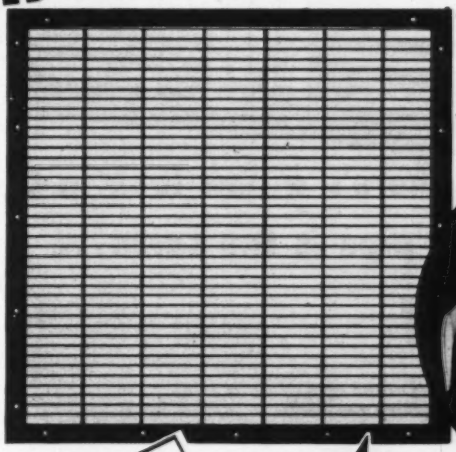
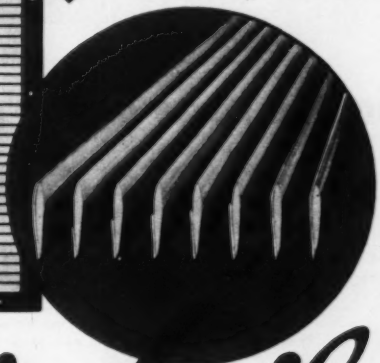
- STANDARD GRADE PRIMER COAT FINISH
- 16 GAUGE STEEL, EXTRA WIDE BORDER FOR EASY MOUNTING



At left—Grille face of LOWER WALL, INDUSTRIAL GRILLE. Note close spacing of extra-strength blades (3/8" centers).

Below—Close-up view of volume control section. Note famous solid section AIRFOIL LOUVERS. Each blade is individually adjustable. CONCEALED LOUVER SUPPORT eliminates mullions and butted construction.



At left—photo shows the 48" x 48" AIRFOIL INDUSTRIAL GRILLE supporting the combined weight of 4 Titus factory workers.

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AIR CONDITIONING OUTLETS

Write for new, FREE complete catalog of Titus AIRFOIL air conditioning outlets—the most efficient grilles ever designed.

Free

More highly efficient . . . longer lasting . . . brand new . . . that's the AIRFOIL-DESIGNED, AIRFOIL-BUILT INDUSTRIAL GRILLE. Clean cut—compact—it is made in two sections . . . Grille Face and Volume Controller.

Rugged—braced for super-strength. The INDUSTRIAL GRILLE will stand up for years and years against the punishing knocks—jars—shocks—scratches and abuse that floor level grilles must take.

Volume Controller section features the famous solid section, streamlined AIRFOIL LOUVERS. Noise and turbulence are cut to a minimum. At the same time, perfect draft-free, air distribution is assured.

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

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- ☐ Perforated metal and ornamental grilles
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- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

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- ☐ Send complete catalog.
- ☐ Send literature on above checked items.

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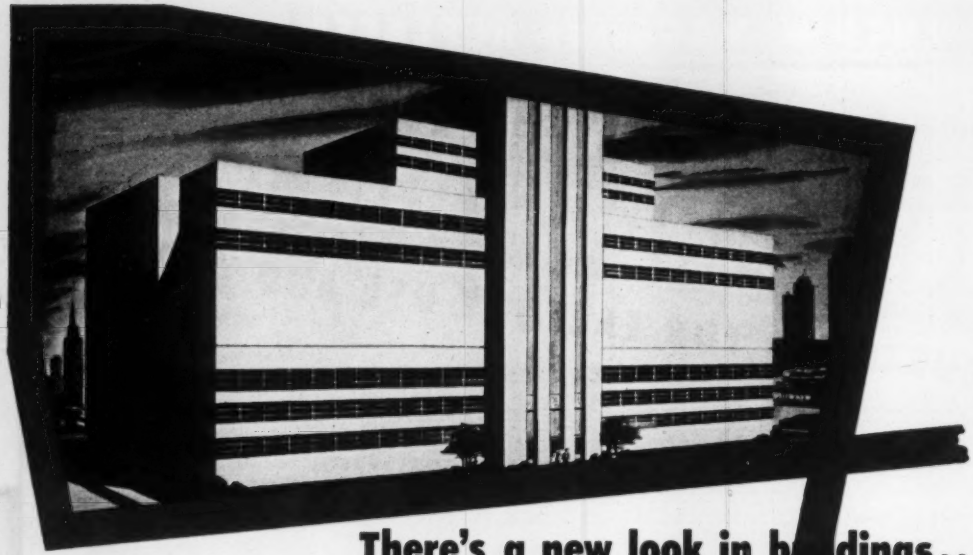

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SPANG CW

Radiant heating is the new look in heating for today's modern office, factory buildings and homes . . . and Spang CW Steel Pipe is your best buy for trouble-free radiant heating in all kinds of structures.

Your men will like the way Spang CW Steel Pipe fits up. It's uniformly top-quality, it bends smoothly and easily, is easy to cut and weld.

Spang CW Steel Pipe gives years of trouble-free service in modern closed-circuit heating systems. It's been a standard piping material ever since closed wet heating was developed, and it is used throughout industry for all kinds of services.

Spang CW Steel Pipe is distributed by leading supply houses everywhere. They handle the things you'll need to go with Spang CW Steel Pipe for radiant heating, snow-melting, and any other wet-type heating system. Tell them what you need . . . in spite of today's great demand for Spang CW Steel Pipe, they'll do everything possible to make deliveries quickly, fairly.

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...SILBRAZ® joints

made with Walseal® Valves and Fittings are installed

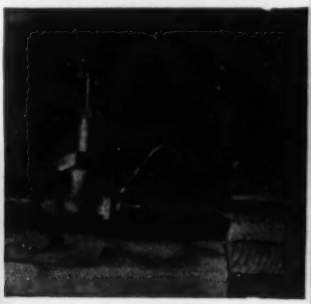
Architects and builders know that it takes modern building components to make a modern building. That's why the first skyscraper erected on the site of the United Nations' buildings has brass and copper pipe runs joined with Silbraz joints – the modern way of joining brass or copper pipe or Type B copper tubing. Silbraz joints are silver brazed – not soldered or threaded – and are stronger than the pipe itself. They are leak-proof, permanent, and will not creep or pull apart under any condition which the pipe or tubing can withstand. They literally form "one-piece pipelines" that save money by eliminating leaky connections, costly maintenance, and repairs.

Walseal Valves and Fittings for making Silbraz Joints

The Walworth Company manufactures a complete line of Walseal Valves, Fittings, and Flanges having factory-inserted rings of silver brazing alloy, for making Silbraz joints. The Walseal material used in the United Nations building was furnished by Glauber, Inc., and Asco Supply Company, Inc., both of New York City.

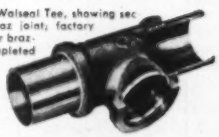
For further information regarding Walseal Valves, Fittings, and Flanges for making Silbraz joints, see your nearest Walworth distributor, or write for Circular 84.

Making a Silbraz joint with a Walseal Gate Valve at UN, work being done at bench.



Installing a Walseal fitting at UN, on location; note operator progressively heats small section of the fitting.

Cut-away view of a Walseal Tee, showing sectional view of Silbraz joint, factory inserted ring of silver brazing alloy; and completed Silbraz joint.



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to give you expert brazing service

He's the Handy & Harman field service engineer. You'll like him because he really knows his stuff. He was hand-picked and specially trained for the job. He is a friendly chap with a wide background of experience that covers both domestic and war time production. He loves to take off his coat and get his hands dirty — and he's an artist with a torch. Give him a brazing problem and he's a bulldog — he'll never let go until it's licked. And if it's too tough to lick on the spot, he's backed by the top-ranking and most experienced Research and Engineering staffs in the business — originators of the well known low-temperature silver brazing alloys EASY-FLO and SIL-FOS. He's ready and eager to give you the following services — without cost or obligation.

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CALL OR WRITE — the nearest office listed below and say when you would like a field service man to call.

HERE'S THE BULLETIN to give you full facts

This new 28-page Bulletin 20 gives the whole remarkable EASY-FLO and SIL-FOS brazing story — including useful information on joint design and fast heating and production methods. It's a "must" for all who design or produce metal assemblies. Write for a copy today.

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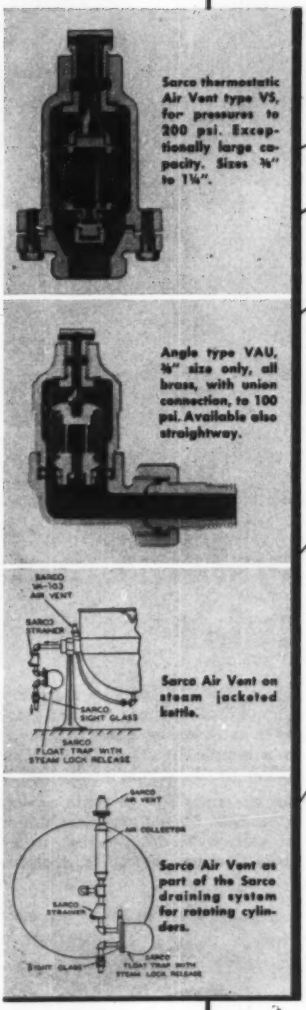

Sarco thermostatic Air Vent type V5, for pressures to 200 psi. Exceptionally large capacity. Sizes ⅜" to 1¼".

Angle type VAU, ⅜" size only, all brass, with union connection, to 100 psi. Available also straightway.

Sarco Air Vent on steam jacketed kettle.

Sarco Air Vent as part of the Sarco draining system for rotating cylinders.

air is expensive

in the wrong place

Air is to be found everywhere – indoors, outdoors, above and below. It's difficult to think of it as expensive – it's so plentiful!

But air is to be found also in the steam spaces of your steam heated equipment. The air dissolved in the feed water supplied to your boilers finds its way into the heaters with the steam.

This air *is* expensive – because it reduces the temperature of the steam, and coats the heating surfaces with a film which retards heat transfer, lowers output, and increases losses.

Remove expensive air from your steam heated machines with SARCO THERMOSTATIC AIR VENTS, scientifically designed for this express purpose.

Write for BULLETIN 2751 and the name of the Sarco man nearest you. He will be glad to help you select the best type of vent for your purpose, and the right place to install it for best results.

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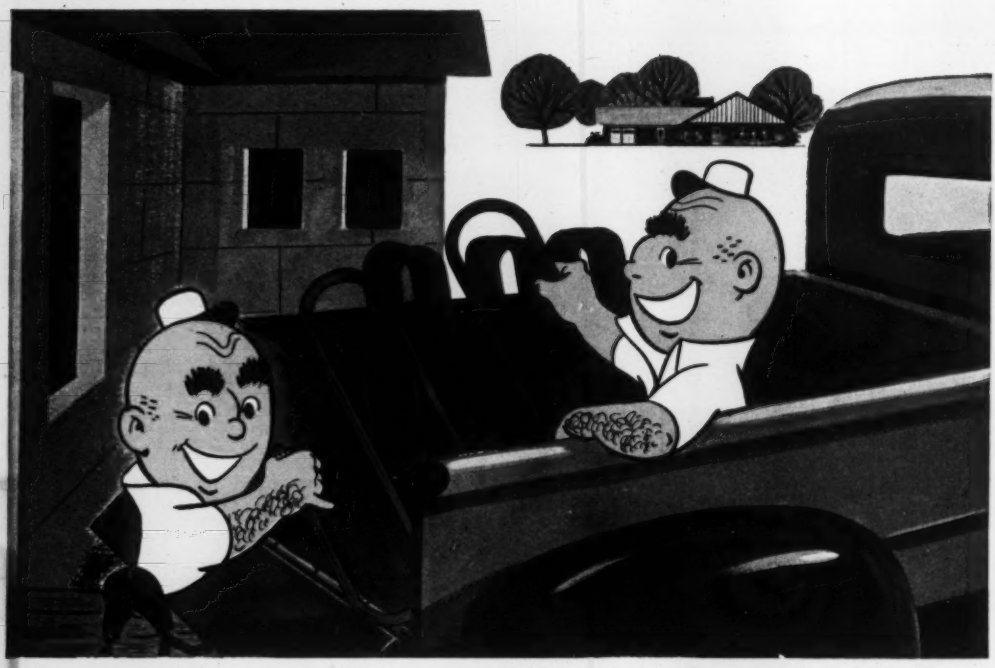


Better radiant heating systems start with Bundyweld Tubing

Bundyweld Tubing performs better in your systems, cuts waste, saves time in fabrication, too.

It stands alone, the only tubing double-walled from a single strip, with an exclusive beveled seam-edge. It's copper-brazed through 360° of wall contact into a smoother, stronger, solid-wall tube that spells leakproof, efficient radiant heating systems right from the start.

Bundyweld comes to you in twenty-foot lengths with one end expanded if specified. It fabricates quickly, easily at your shop or building site. No kid-glove handling; it's ductile, yet extra-strong. One man easily forms Bundyweld on a simple bending fixture. Just two men quickly position the lightweight, rigid grids.

Check your *Sweet's Architectural File* or write us now for more detailed information. Though defense tubing requirements get first call, we'll do our best to fill your needs. ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . . double-walled and brazed through 360° of wall contact.

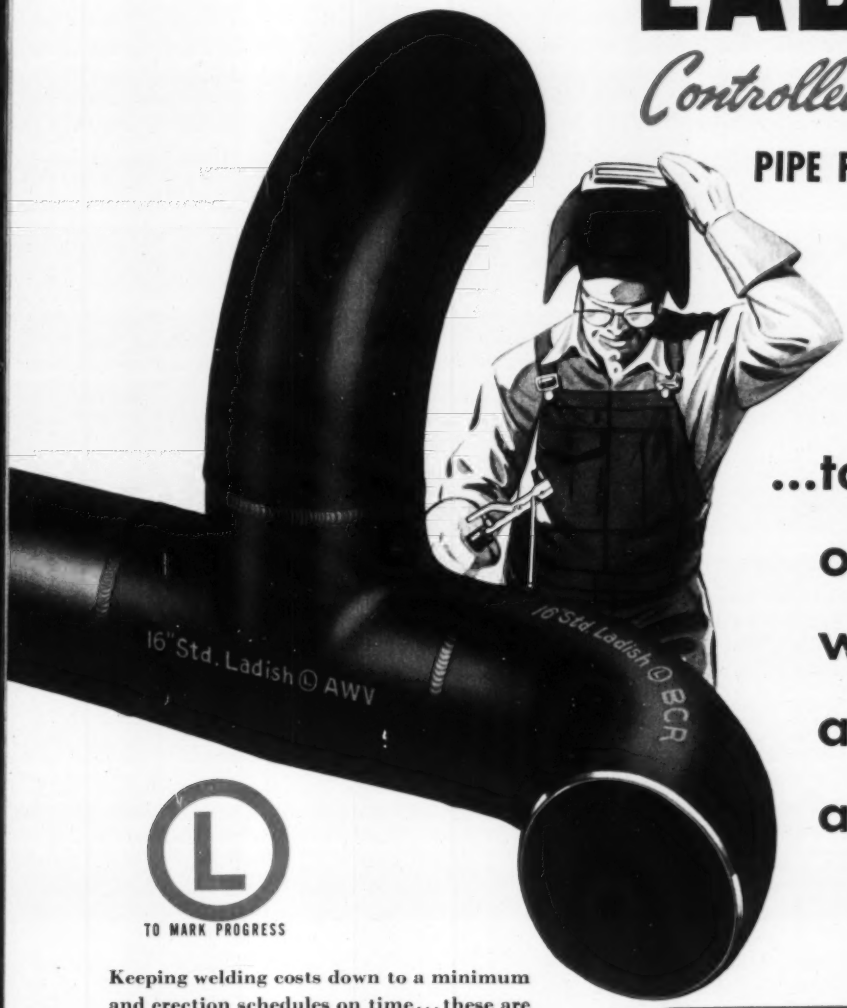
NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS



...to be sure of sound welds and fast assembly

Ⓛ TO MARK PROGRESS

Keeping welding costs down to a minimum and erection schedules on time... these are important advantages you can assure to any piping job by installing Ladish Controlled Quality fittings. Metallurgical controls over materials and methods provide an assurance of uniform weldability in every Ladish fitting... and thorough inspection to rigid standards of physical dimensions and geometric accuracy assures fast piping assembly.

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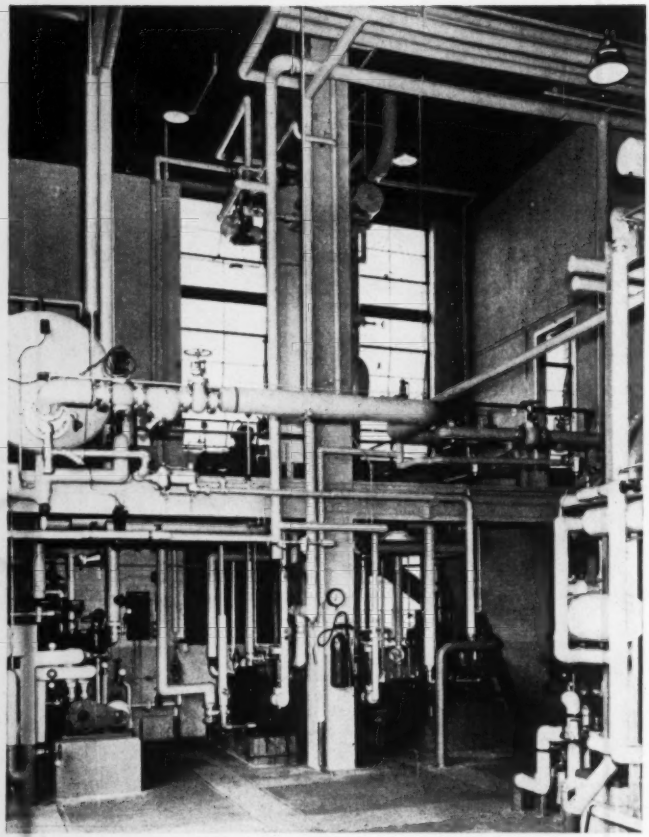

Power house, Middlesex General Hospital, New Brunswick, N. J. Insulation is "Featherweight" 85% Magnesia.
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INSULATION	50°F	100°F	200°F	300°F	400°F	500°F	600°F
DUPLEX							
AIR CELL							
FINF CORRUGATED AIR CELL							
SPECIAL FINE CORRUGATED AIR CELL							
SIMPLEX "SUPER SHRUNK"							
"FEATHERWEIGHT" 85% MAGNESIA							

Most efficient and practical insulation up to 600°F.—

"FEATHERWEIGHT"® 85% MAGNESIA

HIGHLY efficient . . . completely practical . . . easy to apply—no wonder 85% Magnesia is the most widely used insulation in its field today!

Here are facts about "Featherweight" 85% Magnesia—facts that are reasons why this is such a popular and practical insulation:

DELIVERS HEAT WHEN AND WHERE IT'S WANTED! "Featherweight" 85% Magnesia withstands temperatures up to 600° F. without loss of insulating value. Alternate heating and cooling, wetting and drying do not affect its insulating properties.

STRUCTURALLY STRONG—PERMANENTLY EFFICIENT! "Featherweight" insulation, though light in weight, is strong. It can withstand intermittent or continuous vibration; reasonable amounts of compression.

EASY TO HANDLE — EASY TO APPLY! "Featherweight" can be shipped, stored, and handled without any special precautions. It fits snugly to contours without breaking; is easily sawed or cut; can be applied with a minimum number of tools.

SUPPLIED FOR ALL NEEDS: In block form for flat, curved, and irregular surfaces; in sections and sets of segments for standard pipe sizes.

Keasbey & Mattison "Featherweight" 85% Magnesia is one of the complete line of K&M Insulations. Ask your K&M Distributor for complete information; or, write us direct.

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and LOW PRODUCT COSTS
with
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AVAILABLE IN SHAPES, SIZES AND GAUGES TO MEET YOUR NEEDS
FOR PERMANENCE... Hussey Copper and Brass are the ageless metals. With unmatched corrosion resistance as a basic physical characteristic, these metals retain their original beauty for the lifetime of your product.
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Our 103rd year
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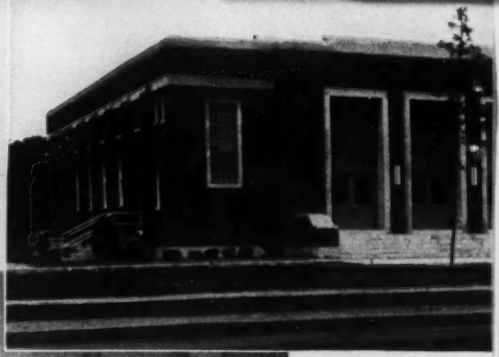
NORFOLK CATHOLIC HIGH SCHOOL, NORFOLK, VA.
Auditorium wing at left, gymnasium wing at right. Cafeteria wing in rear. Under the jurisdiction of the Bishop of Richmond, the Most Rev. Peter L. Ireton. Diocesan superintendent, the Rev. J. Louis Flaherty. Architects: Gleeson and Mulrooney, Philadelphia. Associate Architect: T. David Fitzgibbon, Norfolk. Consulting Engineer: William G. Flurer, Philadelphia. Heating Contractor: Coley and Petersen, Norfolk.



Webster Walvector in auditorium on separate zone, one of five, permits use for evening parish affairs without heating entire school.

Webster Walvector in classroom spreads the heat along outside wall . . no drafts . . no hot spots.

WEBSTER HEATING EQUIPMENT FOR SCHOOLS

RADIATION

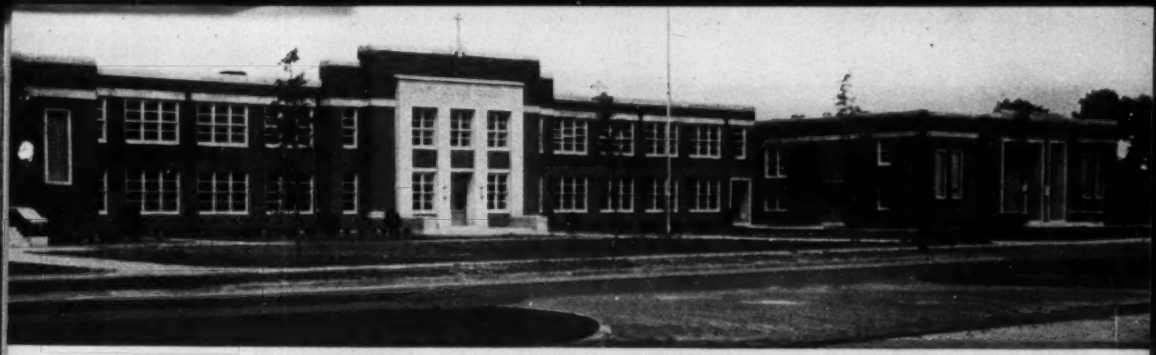
Webster Walvector Radiation. Webster-Nesbitt Unit Heaters. Webster System Convector Radiation : : Webster Baseboard Heating

HEATING CONTROLS

Webster Moderator Systems of Steam Heating : : Webster Continuous Flow Hot Water Heating Control : : Webster Control Valves

STEAM HEATING SPECIALTIES

Webster Thermostatic Traps : : Webster Radiator Valves
Webster Heavy Duty Drip Traps : : Webster Dirt Strainers



Solves Heating Design Problems in

500-STUDENT HIGH SCHOOL

The designers of the new Norfolk Catholic High School were able to attain long sought objectives by using Webster Walvector Radiation and forced hot water for the basic heating need, supplemented by Webster Convectors and Webster-Nesbitt Unit Heaters.

Economy in first cost was helped by the simplicity of Webster Walvector with its reduction in distribution piping and use of only limited space, well illustrated in the auditorium view at the left.

Comfort was assured by spreading the heat the full length of the outside wall . . . no drafts . . . no hot spots . . . a minimum of covered exposed piping, evident in the class room view at the left below.

Minimum operating costs for the years to come were obtained by division of the installation into five zones and by using Webster-Nesbitt Unit Heaters with separate controls in the cafeteria-kitchen.

This installation has been through its first full heating season and has proved the soundness of the designers' conception. Webster Walvector has been installed in a long list of new school buildings. For information about Walvector and other Webster products for school heating, call the Webster Representative or write us. Address Dept. HP-6

WARREN WEBSTER & COMPANY

Camden 5, New Jersey : : Representatives in Principal Cities
In Canada, Darling Brothers, Limited, Montreal

Webster WALVECTOR

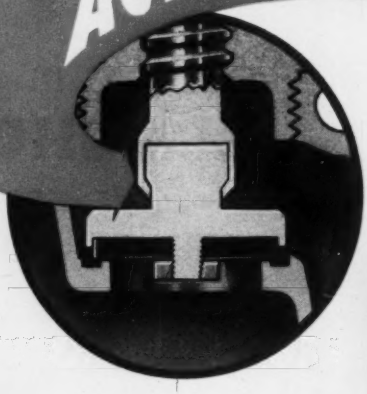
For Steam and Hot Water Heating

Webster Walvector in girls' locker room. Webster Convector in toilet.

O-B FREE-SWIVELING ACTION

No. 3 LINE COMPOSITION DISC VALVE

100 lbs. W.S.P.
150 lbs. W.O.G.
Available in globe type, with or without waste, angle type also available.



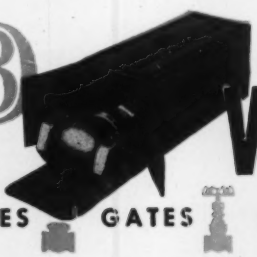
REDUCES DISC DAMAGE

O-B *Composition Disc* Globes and Angles shut off with a smooth, non-grinding action that lessens disc damage and guarantees better valve performance.

The section view shown above tells the reason why. You will notice that the disc holder is attached to the valve stem with a free-swiveling connection. As the valve is closed, the disc stops turning on first contact with the raised seat. The free-swiveling disc holder permits further tightening without causing damage or excessive wear to composition discs. As a result, discs last longer and valves remain leaktight for many years without requiring disc replacement.

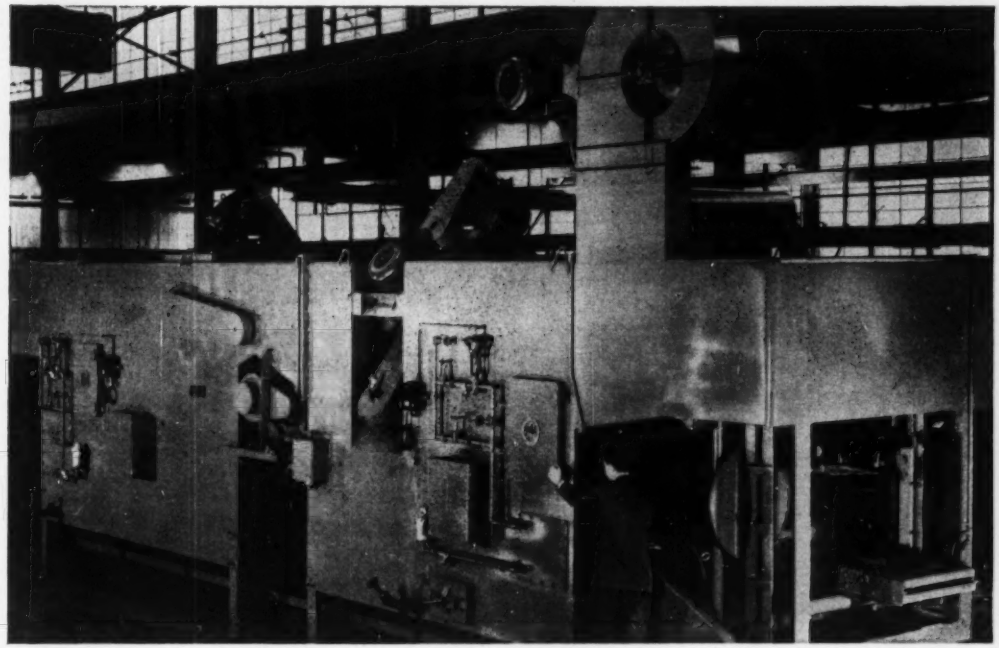
To insure complete customer satisfaction, buy O-B composition disc valves for your next plumbing or heating job. A full line of globes and angles with either screw-type or solder-type ends is available from your local Ohio Brass Company distributor. See him for any of your plumbing and heating supplies.

OHIO BRASS CO. MANSFIELD, OHIO

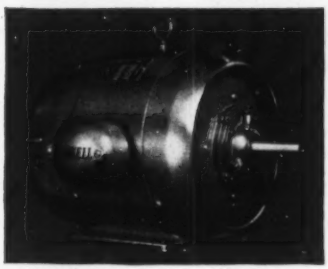


Ohio Brass VALVES

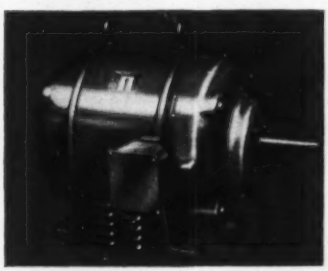
BRONZE GLOBES ANGLES GATES AND CHECKS



How to give a cylinder block a clean start



Howell Type K Motor. Offers constant performance in the presence of dirt, dust, fumes and moisture. Sizes 3 to 150 H.P. at 1800 R.P.M. Either vertical or horizontal mounting.



Howell Type F Motor. A high-slip, high-torque motor designed for punching and shearing operations. Sizes ½ to 200 H.P. in open frames; ½ to 125 H.P. in enclosed frames.

This new Centri-Spray washer thoroughly cleans up to 400 cylinder blocks an hour. It often runs 3 shifts a day, six days a week. A tough job for the nine Howell Industrial Motors which power it!

Four 25-H.P. motors operate the unique Centri-Spray units which envelop the rotating blocks with a powerful high-volume spray of water. A high-head centrifugal pump, equipped with a 15-H.P. motor, flushes blocks internally. All foreign matter is *completely removed*, inside and out. Four motors, from 1/3 to 20 H.P., power the automatic sludge remover, the recirculating pump, the main conveyor and the high-pressure blowoff fan.

Howell engineers worked closely with this manufacturer to provide the *right* motor for each application. As a result, this Howell-powered washer easily takes the hardest operating schedule in stride.

Highest quality motors, designed for your specific jobs, are typical of the service you get from Howell. Let us handle your electric motor needs. You'll find precision-built Howell industrial type motors a profitable investment that pays off in extra years of dependable performance.

HOWELL ELECTRIC MOTORS COMPANY

Howell, Michigan

HOWELL Red Band MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built industrial motors since 1915

How to cut maintenance *Overhead*

Bryant Model 322 Unit Heater with A.G.A. inputs of 110, 135, 175, 210 thousand Btu per hour.

Best bet for your industrial or commercial heating installation is *the* unit heater you can sell on the basis of *least maintenance.* That's where your customer looks for long-range economy and lasting satisfaction.

Tell him of the trouble-free operation of Bryant Gas Unit Heaters . . . how their specifically designed unit heater controls eliminate failures . . . how proper heat exchanger design prevents burnouts and squeezes a maximum of heat from every dollar's worth of fuel . . . how simple, time-saving installation of these Bryants meets his needs for comfort heating that's quick, automatic and without waste. These advantages mean *savings* for him.

And, once installed, you can count on these Bryant Unit Heaters for fewer call-backs . . . less trouble *overhead.* That's money in the bank for *you!*

For a more complete story, contact the Bryant Distributor nearest you or write direct. Bryant Heater Division, Dept. 155, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, O.

Let the pup be furnace man . . . and water boy, too!

bryant

AUTOMATIC HEATING

Your *single* source of supply for everything in gas heating equipment!

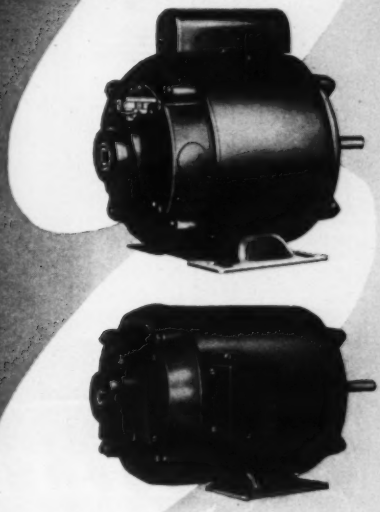
Century MOTORS

FOR HEATING, VENTILATING AND REFRIGERATION

Assure Satisfactory Performance

Because:

- Speed operating characteristics provide top performance for each kind of equipment they drive.
- They start quickly and run quietly.
- Sturdy construction assures long life—ventilation resists dampness in basements where much of equipment is used.
- An Authorized Century Service Station is near to give fast service when it is required. Get acquainted with your Century Service Station operator.



Typical Century Motor Applications

- **Oil Burner Motors** — meet requirements of underwriters — each motor is balanced — smooth, trim appearance, easy to clean — compact dimensions — all mounting dimensions industry standard.
- **Unit Heater Motors** — NEMA standard for shaft mounted Fans and Blowers. Furnished: single speed — two speed or adjustable speed. For operation on single or polyphase or direct current.
- **Fan or Blower Motors** — For attic fans — window fans — exhausters — air spreaders — furnace blowers. A. C. — D. C. Motors for all forms of air moving jobs.
- **Stoker Motors** — For home and commercial sizes.
- **Refrigeration Compressor Motors** — Up to 400 H. P. —single or multi-speeds — high starting torque for hard-to-start loads — designed for use with automatic starters for refrigeration cycling. Century motors are widely known for their unusually quiet *starting* and *running*.
- **Pump Motors** — Up to 400 H. P. — for water circulating heating systems — refrigeration systems — all form of liquid moving.

Century offers a wide range of types and sizes up to 400 H. P. — with operating characteristics to suit the wide range of driven equipment. Call a Century Branch sales office or your local distributor.

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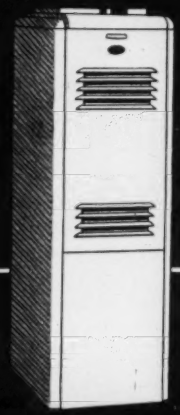
Century C MOTORS

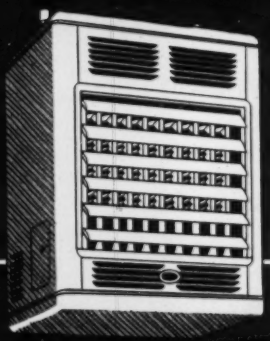
Century Electric Company Is Celebrating its 50th Year in the Electrical Industry

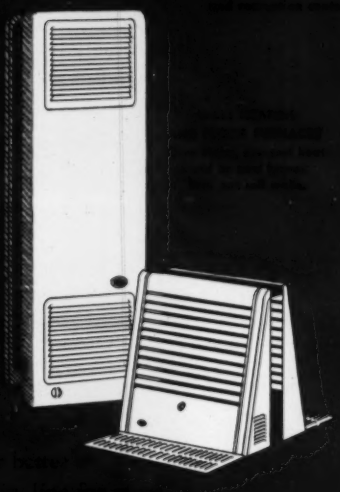
more profits in every direction with

UTILITY

AUTOMATIC GAS HEATING EQUIPMENT







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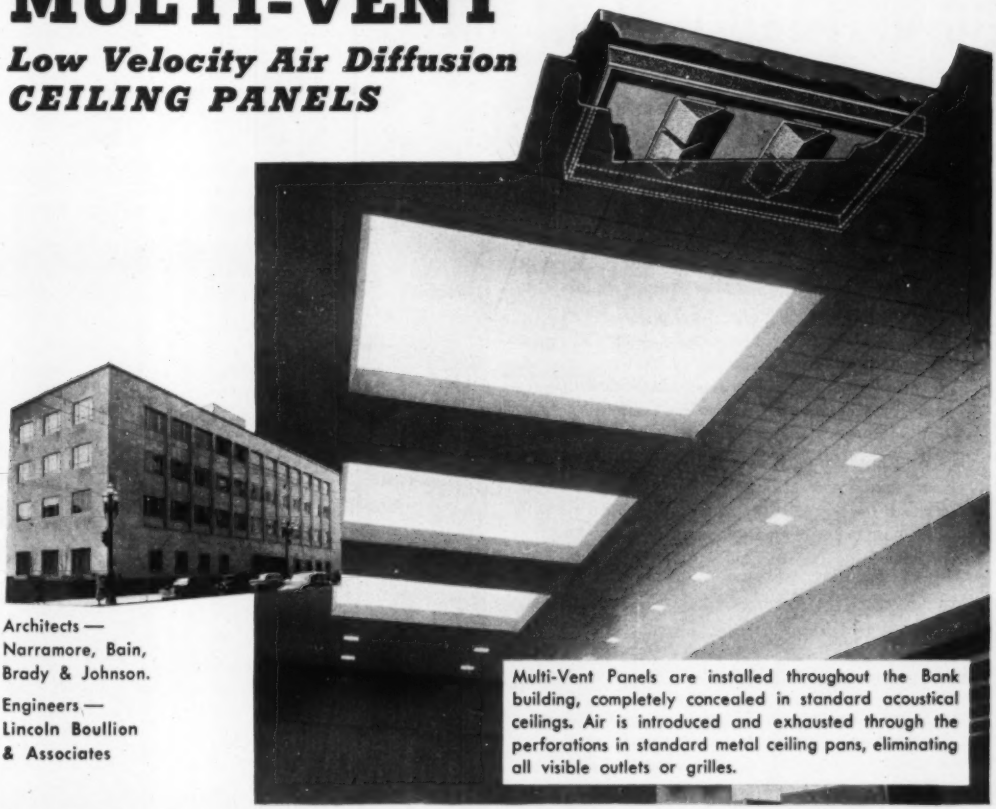
MULTI-VENT

Low Velocity Air Diffusion CEILING PANELS



Architects —
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Engineers —
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Multi-Vent Panels are installed throughout the Bank building, completely concealed in standard acoustical ceilings. Air is introduced and exhausted through the perforations in standard metal ceiling pans, eliminating all visible outlets or grilles.

For *COMPLAINT-FREE* Heating and Ventilating

IN THE SAN FRANCISCO FEDERAL RESERVE BANK, SEATTLE BRANCH

Top-flight engineers and architects are now specifying Multi-Vent for air distribution in virtually every type of commercial and industrial building, new or old, *where true comfort*, or where perfect uniformity and accurate control of air movement, temperature, and humidity is demanded by their clients.

For unlike any other diffuser on the market today, Multi-Vent panels do *not* depend on BLOW or THROW, (high velocity injection) for distribution. In fact Multi-Vent provides perfect over-all air distribution entirely by pressure displacement, completely free from BLOW.

This pressure displacement principle, exclusive with Multi-Vent, does away with the main sources of draft hazards . . . thereby eliminating all of the most serious installation, balancing, and adjustment problems, inherent in the velocity injection principle, upon which all air diffusers *except* Multi-Vent depend.

Multi-Vent is by far and away the best, not only in performance, but in efficiency, appearance, and economy of maintenance as well.

See Sweet's Arch. & Eng. Files or write for detailed literature and the name of the Multi-Vent sales engineer in your vicinity.

THE PYLE-NATIONAL COMPANY
1373 NORTH KOSTNER AVENUE, CHICAGO 51, ILL.

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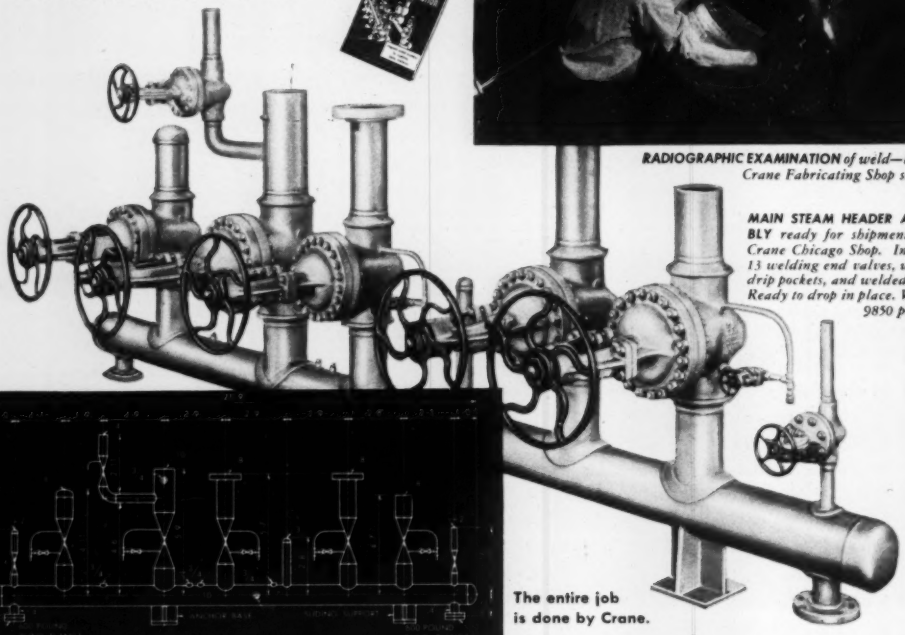
no unit fabrication job too tough for CRANE

Whether your piping project calls for a simple pipe bend . . . or a complex welded assembly . . . Crane fabricating facilities can handle it. No pipe shop is better equipped to do your *entire* job from drawings of *your* design.

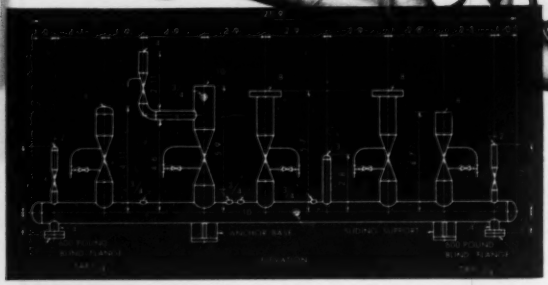
At Crane all steps of fabrication—such as bending, welding, stress relieving or heat-treating, radiographic examination, hydrostatic testing—are rigidly checked under procedure control to maintain adequate standards of accuracy and quality.

And because each assembly is tested as a unit, with major assemblies proved in advance of installation—you can erect your piping systems with minimum expense and delay. For further information, **ask for Folder AD-1771.**

RADIOGRAPHIC EXAMINATION *of weld—typical Crane Fabricating Shop service.*



MAIN STEAM HEADER ASSEMBLY *ready for shipment from Crane Chicago Shop. Includes 13 welding end valves, welded drip pockets, and welded bases. Ready to drop in place. Weight 9850 pounds.*



The entire job is done by Crane.

CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Tri-Flex Aerovane

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Architects, engineers, contractors — planners and builders of tomorrow — choose their materials with care. The quality of the completed job depends on them. And the specialists responsible for the successful, dependable operation of an air conditioning system pay strict heed to the proper selection of the air distribution equipment... *the point where success is measured.*

In the 525 William Penn Place Building — as in important buildings from coast to coast — the choice was the outstanding combination of Tri-Flex and Aerovane Grilles and Registers... the combination that insures maximum flexible control of air delivery ... meets the most exacting requirements of performance. For consistent quality that guarantees the results, standardize on Tri-Flex and Aerovane. For complete information, write for Catalog 48S.

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NEW BRITAIN, CONNECTICUT

ENGINEERED PRODUCTS FOR HEATING, AIR CONDITIONING AND VENTILATING

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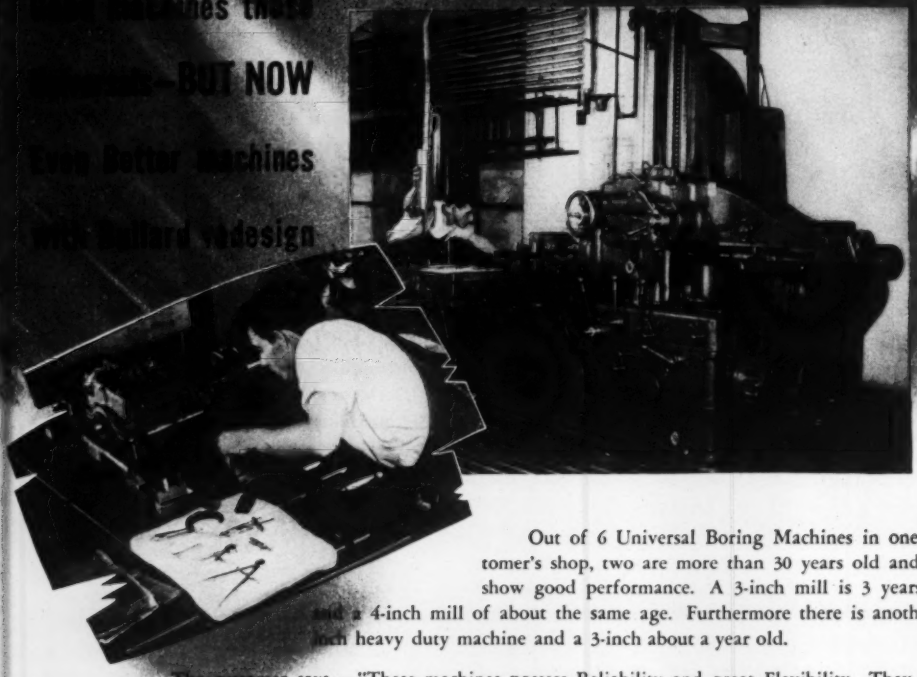
Consistent Service

Machines there

—BUT NOW

Even Better Machines

With Bullard redesign



Out of 6 Universal Boring Machines in one customer's shop, two are more than 30 years old and still show good performance. A 3-inch mill is 3 years old and a 4-inch mill of about the same age. Furthermore there is another 4-inch heavy duty machine and a 3-inch about a year old.

The customer says — "These machines possess Reliability and great Flexibility. They meet our requirements because our work is so diversified and yet we require a very accurate machine for back boring, which is a complicated operation done accurately on these machines."

The foregoing bespeaks Consistent Service from the old line of machines. NOW the new heavier design with 4-WAY BED, features providing longer useful life with maintained Accuracy, hydrodynamic main drive with brake motor, Traybon lubrication system for ways and external bearings make Bullard Horizontal Boring, Milling and Drilling Machines an important item for your very earnest consideration.

THE BULLARD COMPANY · BRIDGEPORT 2, CONN.

Ask a **BULLARD** representative to outline the application of a **BULLARD** Horizontal Boring Mill to your work.

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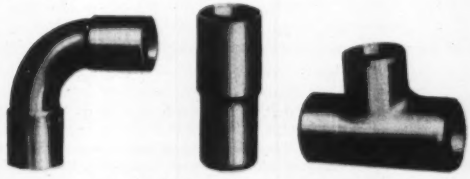
...it must be a
Streamline®
fitting!

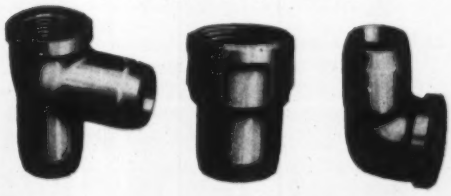
Streamline® solder type fittings are really made to last . . . and they'll make a neater, quicker installation

If Cleopatra's plumber had used STREAMLINE fittings we wouldn't be surprised if they would still be in pretty serviceable condition today. For STREAMLINE solder type fittings are really made to last. They cannot rust, they're not loosened by vibration and they're virtually free from clogging. STREAMLINE fittings assure a snug-fitting, tightly joined system that tests leak-proof on the first try and doesn't develop leaks later. When you install STREAMLINE fittings, you can be sure you're installing a permanently reliable conducting system whether for plumbing, heating, air conditioning or industrial use.

And here's something else . . . because of their design, precision manufacture and accurate dimensions, STREAMLINE solder type fittings can be installed quickly and the uniform depth of the solder joints makes it easy to compute the exact length of tubing needed. Thus STREAMLINE fittings not only assure a permanent installation, they also reduce job cost and increase the number of installations a contractor can handle.



STREAMLINE wrought and cast fittings are available in a complete range of standard sizes.



See your jobber for further information or write for catalogs S-351 and W-251 describing our complete line of STREAMLINE wrought copper and cast bronze fittings.

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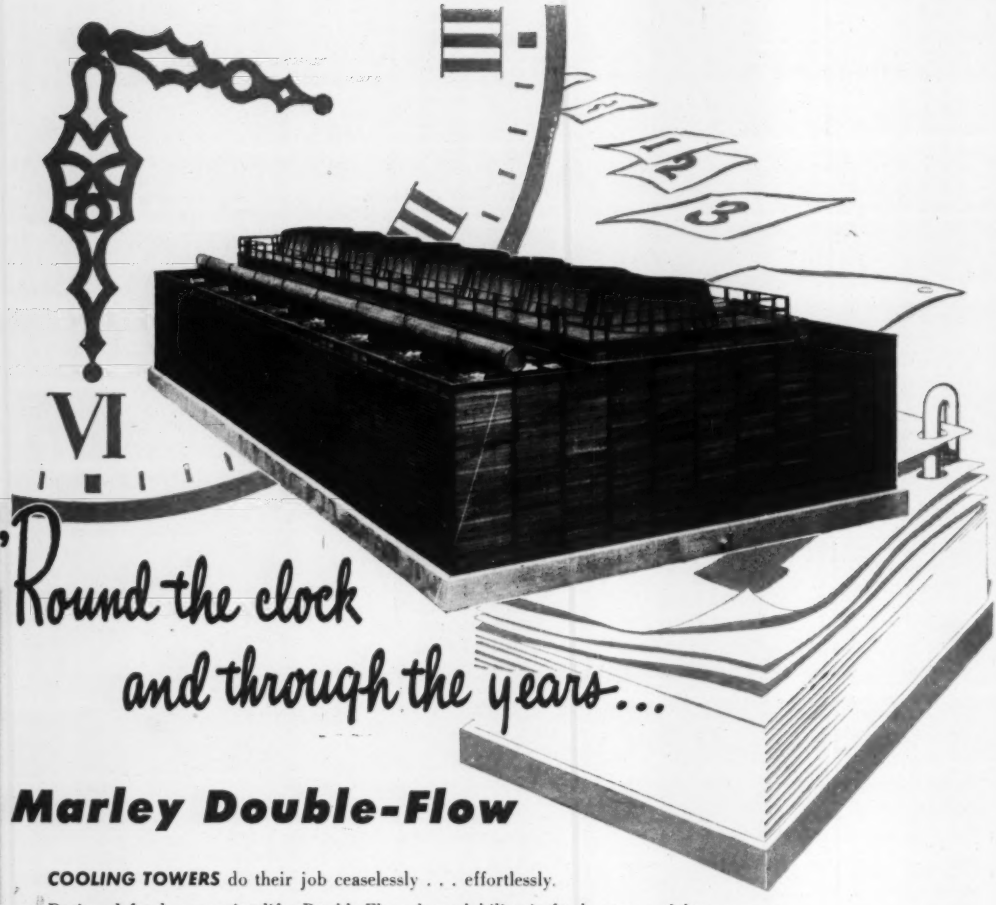
MUELLER BRASS CO. STREAMLINE PRODUCTS

MUELLER BRASS CO. PORT HURON 1, MICHIGAN



'Round the clock
and through the years...

Marley Double-Flow

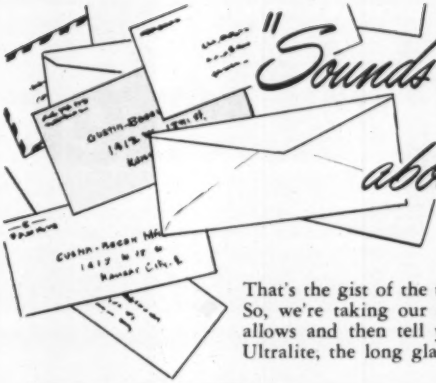
COOLING TOWERS do their job ceaselessly . . . effortlessly. Designed for long-service life, Double-Flow dependability is further assured by the patented design that makes possible "at-a-glance" inspection, on-the-spot maintenance—all without service shutdowns or lag in plant production.

The famous Marley open distribution system keeps the operator informed at all times on water conditions, and may be cleaned in minutes, during operation. By merely opening a door, the operator can walk through the entire tower, inspecting all essential parts as the Double-Flow continues to do its duty.

Marley fans, Geareducers, drive shafts—all designed for cooling tower service exclusively—are keyed to this same service simplicity. Mechanical equipment . . . distribution . . . filling . . . basin . . . from top to bottom and side to side, Double-Flow towers and *only* Double-Flow towers are an open book to the tower operator—a book that tells a story of ceaseless, effortless operation.

The Marley Company, Inc.
KANSAS CITY 15, KANSAS

MARLEY



"Sounds wonderful — tell us more about ULTRALITE INSULATION!"

That's the gist of the thousands of letters and cards you ad readers have sent in. So, we're taking our cue from you; we'll be as specific and detailed as space allows and then tell you how to get the complete, up-to-the-minute story on Ultralite, the long glass fiber insulation.

Facts for the MAN WHO SPECIFIES Ultralite

Ultralite consists of long, strong, drawn glass fibers, bonded with a thermo-setting plastic resin. It is manufactured in continuous blanket rolls that are semi-rigid, yet resilient. These blankets have all the inherent characteristics of glass itself, except that they are soft, light and flexible. Ultralite is available in thicknesses from ½" to 6" and in ¾, 1, 1½, 2 and 3 lbs. per cu. ft. densities. Roll widths range from 18" to 120"; roll lengths vary, depending on thickness. Ultralite is also available in cut-to-size pieces.

THERMAL CONDUCTIVITY

Product	Density	"K" Value at 60° Mean Temp.
Ultralite "75"	¾ lb. per cu. ft.	.253
Ultralite "100"	1 lb. per cu. ft.	.246
Ultralite "150"	1½ lb. per cu. ft.	.235
Ultralite "200"	2 lb. per cu. ft.	.233
Ultralite "300"	3 lb. per cu. ft.	.217

FOR FULL DETAILS, Check "A.I.A. Folder" and "Facings Folder" on coupon.

Facts for the MAN WHO APPLIES Ultralite

Your applied cost is less; profit greater. One reason: Ultralite is 100% usable — no loss due to breaking, chipping, flaking or denting. Another reason: Ultralite goes on faster and cheaper. You can cut it with a knife, run it around curves, corners, valves and fittings. You can fasten it in place with adhesives, screws and washers, wires — even staples. Compressibility and resilience make it easy to use in "tight spots".

Ultralite is available plain or with your choice of 7 attractive facings (some vapor barriers) already adhered to insulation. Comes cartoned in compressed rolls that are easy to store. Extremely lightweight, easy to carry, pleasant to handle. Available in various weights and thicknesses, for all types of heating, piping, air conditioning applications and for metal buildings.

FOR FULL DETAILS, check coupon and mail today.

Facts for the MAN WHO BUYS Ultralite

You get effective thermal and/or acoustical protection that's as permanent as glass itself. For Ultralite won't burn or rot. It won't shake down, settle, sag or disintegrate, even under vibration. It will not support rodents, fungus, termites, bacteria or vermin. It won't absorb moisture or odors. And it will not corrode metal.

You get an insulation that won't break, dent, chip or otherwise lose its effectiveness. For Ultralite is resilient — absorbs bumps and then fluffs back out to original shape and thickness.

You get an insulation that is recognized as superior by manufacturers of automobiles, railroad cars, trucks, trailers, buses, appliances, LCL containers, metal buildings, laundry machinery, coolers and insulated original equipment of all kinds. Ultralite is also a favorite with those who've used it as duct insulation, duct liner, furnace jacket liner, and piping insulation.

FOR FULL DETAILS, check "General Folder" on coupon and mail today.

GUSTIN-BACON MFG. CO.

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HP-6

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- ☐ A.I.A. File 37-D-2 (Ultralite Duct Insulation and Duct Liner)
- ☐ Ultralite Piping Procedure Manual
- ☐ Ultralite Folder on Metal Buildings
- ☐ Ultralite Facings Folder
- ☐ Ultralite General Folder

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Company.....

Address.....

City.....

State.....

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1412 West 12th Street Kansas City, Missouri

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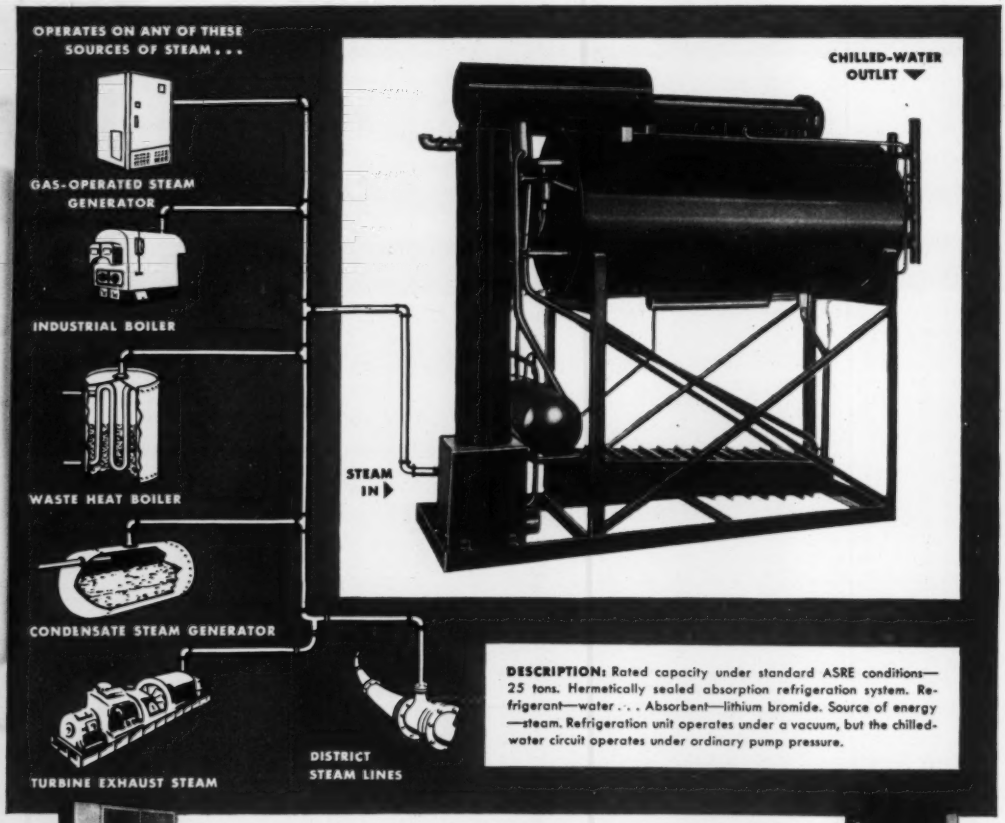
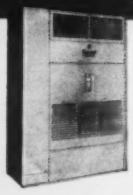
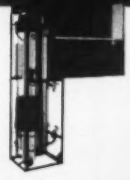

OPERATES ON ANY OF THESE SOURCES OF STEAM . . .
GAS-OPERATED STEAM GENERATOR
INDUSTRIAL BOILER
WASTE HEAT BOILER
CONDENSATE STEAM GENERATOR
TURBINE EXHAUST STEAM
DISTRICT STEAM LINES
CHILLED-WATER OUTLET
STEAM IN
DESCRIPTION: Rated capacity under standard ASRE conditions—25 tons. Hermetically sealed absorption refrigeration system. Refrigerant—water . . . Absorbent—lithium bromide. Source of energy—steam. Refrigeration unit operates under a vacuum, but the chilled-water circuit operates under ordinary pump pressure.



SERVEL STEAM-OPERATED AIR CONDITIONERS

Self-Contained Unit. 5 tons of refrigeration. Heating optional.

Absorption Refrigeration Unit. In 3- and 5-ton sizes. For single or multiple installations.



Chiller opens application flexibility

25-Ton Servel Absorption Unit Provides Long-Life Refrigeration from Inexpensive Steam

The application flexibility of this new Servel Water Chiller makes it an economical source of chilled water for most applications. These points show how easily it will fit your requirements:

NUMEROUS USES—Comfort air conditioning . . . industrial temperature and humidity control . . . precooling for air compressors and internal combustion engines . . . chilled water for manufacturing processes . . . and many others.

STEAM OPERATION—Use the cheapest source of steam . . . any pressure will do. Use the cheapest fuel to make steam—waste heat or manufacturing by-products if available . . . or waste steam.

SIMPLE INSTALLATION on any floor from basement to penthouse . . . in multiple or single installations . . . low floor loading . . . no vibration . . . quiet operation.

MODULATION—Use simple steam controls to reduce capacity of the Servel unit as much as 50% . . . with no appreciable loss of efficiency.

In addition to these important flexibility factors, the new Servel Water Chiller also offers the famous Servel no-moving-parts freezing system. This insures dependable operation, long life, and low maintenance. Add this advantage to its numerous uses, its steam operation, simple installation and capacity modulation, and you'll choose the new Servel Water Chiller* every time.

Mail coupon now, for complete information.

*NOTE: The nation's present need for critical materials limits the availability of the Servel Water Chiller to defense orders at present. However, the Servel equipment shown at the bottom of the opposite page is available without priorities.

HERE ARE SOME REASONS WHY SERVEL IS YOUR BEST AIR CONDITIONING BUY

- **No Moving Parts to Wear**
- **Low Maintenance Costs**
- **Hermetically Sealed Circuits**
- **Long Life**
- **Complete Safety of Operation**
- **Chilled Water Circuit Operates Under Normal Pump Pressure**

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HOUSEHOLD REFRIGERATORS

Servel, Inc.
Department R-26, Evansville 20, Indiana

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Servel 25-Ton Water Chiller_____
Servel Self-Contained Air Conditioner_____
Servel 3- and 5-Ton Refrigeration Units_____

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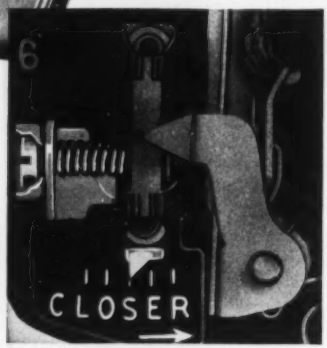
Uniform room temperature—controlled within a fraction of a degree • Elimination of the waste and discomfort of over and under heating • Greater fuel economy • Automatic adjustment of heating to all existing influences, such as outside temperature, wind direction and velocity, solar radiation, etc. • Geared-to-the-weather heating.



a turn of a screw

tailors temperature control to fit any installation!

DETROIT'S No. 411-CH *Timed Cycling* Thermostat is a natural for all your new installation and conversion jobs. Equipped with an easily adjustable parallel heater, the No. 411-CH can be swiftly adapted with minimum effort to provide maximum comfort under a wide variety of installation conditions. With a simple turn of a screw, cycles can be shortened or lengthened to fit the specific installation without disturbing the factory settings. Because the unique *Timed Cycling* parallel heater is not affected by variations in the electrical load, this remarkable thermostat may be used on *all* types of installations and is particularly well adapted to conversion burner work where the heating unit is either over or under size. In addition, the *Timed Cycling* Thermostat eliminates the need to select a special heater by giving you *one* heater adaptable to *all* jobs. This exclusive feature greatly simplifies inventory, installation and service problems and assures your customers the utmost in heating comfort. For complete information see your DETROIT wholesaler today.

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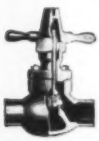
Serving home and industry. AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

HENRY *really gives you something extra*

a few of many outstanding advantages



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IN STRAINERS, forged brass end caps with integral fittings, reinforced screen, large filtering area, distortion-proof clean-out flange

IN DRIERS, forged brass end caps with integral fittings, natural finish, Abso-Dry pressure sealed, dispersion tube and extra capacity

IN WING CAP VALVES, greater flow, bolted bonnet and self-aligning stem disc

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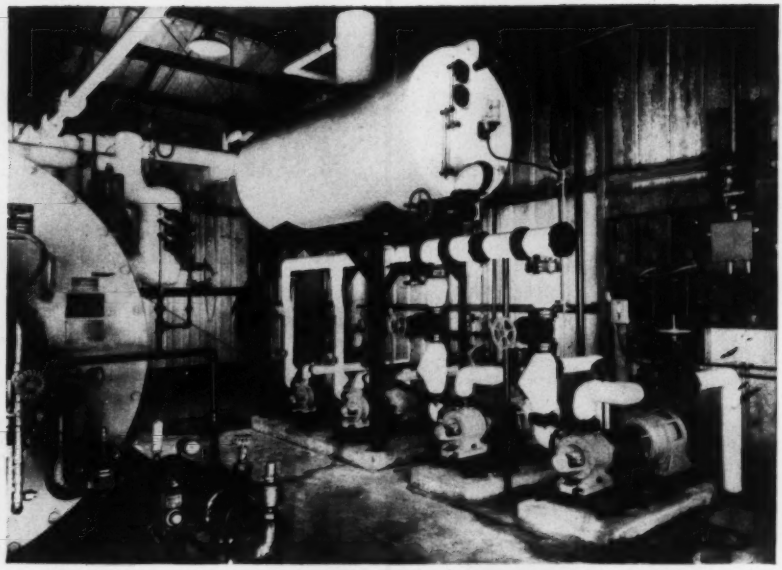
CABLE: HEVALCO, MELROSE PARK, ILLINOIS

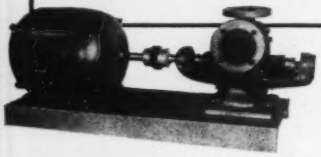


Schaub Duplex Deaerator System, installed in a new Pacific Northwest plant, handling one 100 H.P. and one 800 H. P. packaged boilers, 150 lbs. working pressure.

You Get **MORE** in a **SCHAUB**

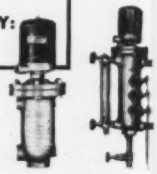
BOILER RETURN SYSTEM

THIS EXCLUSIVE COMBINATION OF *"Plus Values"* TELLS WHY:



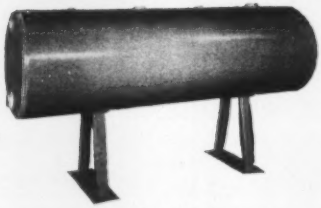
Schaub Master-Bilt Turbine Pump

Patented fleximatic shaft seals and prelubricated ball bearings mean no packing and no greasing — *ever!* When you install a Schaub Master-Bilt Pump you can forget about it.



Ultra-Dependable MAGNETROL Boiler Water Level Control

Combination pump control and low water safety cut-off. Friction-free Magnetrol assures boiler safety. No bellows to stiffen, no packing in head, no tricky electrode circuits to fail. All models approved by Underwriters' Laboratories, Inc.



Chromosoid-Lined Receiver

10-year guarantee against corrosion. Schaub engineers developed Chromosoid lining by working with leading chemical researchers. You're protected against costly and premature replacements. No more rust-clogged systems.

Each of these, along with other features, combine to produce the high overall efficiency, economy and long-lasting service characteristic of every Schaub System. Operators who buy on the basis of facts and performance find that they get more out of a Schaub System because a Schaub System has *more to give them.* When a Schaub System is compared with any other, the *least* difference is the difference in price! That's just another way of saying *you pay less per year for a Schaub System.*

Know the Facts! Schaub also builds Patented Heat Reclaim and Spray-Type Deaerating Systems for exacting requirements from 10 to 1000 boiler horse power. Write for new Schaub Catalog No. 55 which gives more information on all types of Schaub Systems.

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- *The Kritzer Way.*

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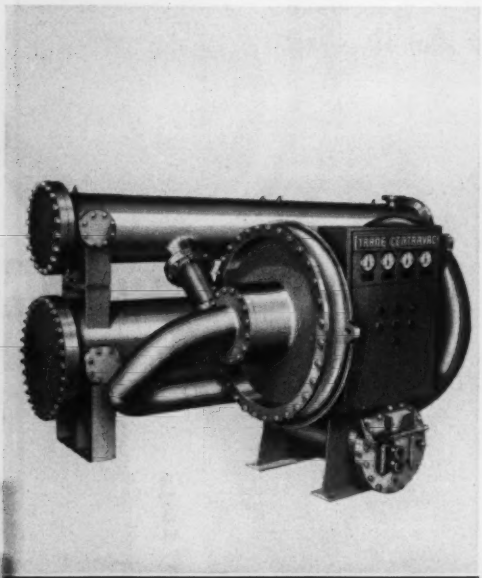
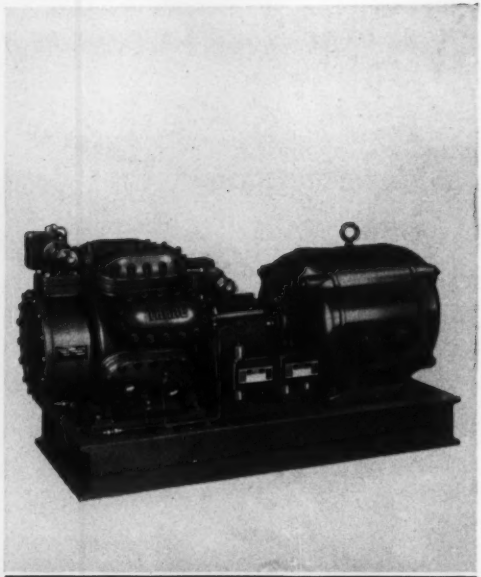


Trane CenTraVac—Hermetic Centrifugal Refrigerating Unit—Six models starting at 45 tons.



Trane Reciprocating Compressor and Condensing Units—Six models up to 50 tons in capacity.

From Equipment Room to Penthouse

Many architects, engineers and contractors are discovering new advantages in the complete Trane line of heating, cooling and air conditioning equipment.

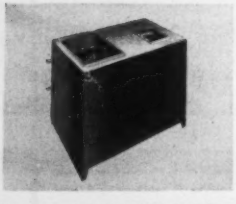
Trane manufactures equipment ranging all the way from a centrifugal compressor capable of developing more than 200 tons of refrigeration to a cooling coil small enough to carry under your arm. All the way from a tiny radiator valve to a 108" fan.

All this equipment is designed by one integrated staff of product engineers all working together. All this equipment is built in Trane plants under one all-inclusive factory staff. All Trane products are carefully tested and rated by one complete laboratory directed by a single management.

Matched Products. The result—all Trane products are designed and manufactured for use together. Each product is matched with every other Trane product for maximum service.

When Trane products are used together to provide air conditioning, heating and cooling for any type of building or for process, they offer:

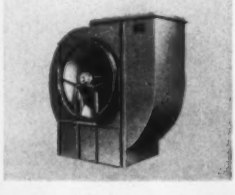
1. Undivided Responsibility—one manufacturer—Trane—assumes the complete responsibility for the correct rating and performance of all the equipment if properly installed and controlled—no blaming the maker of the evaporative condenser if the compressor won't work.



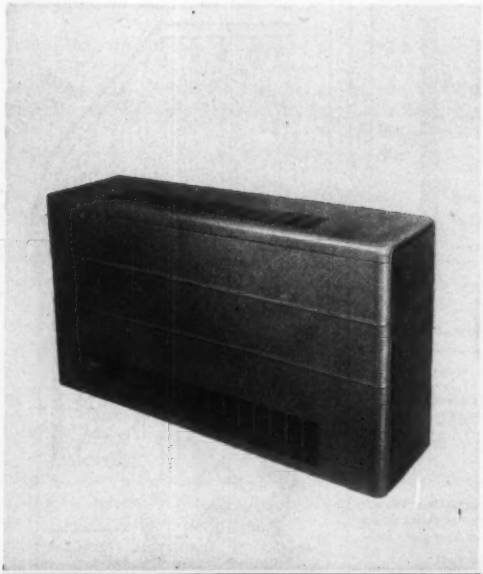
Trane Evaporative Condenser—For condensing refrigerants in the air conditioning system with the minimum use of water.

Trane Sprayed Coil Unit—For built-up systems requiring separate fan motor and drive and filters. Heats, cools and washes air.

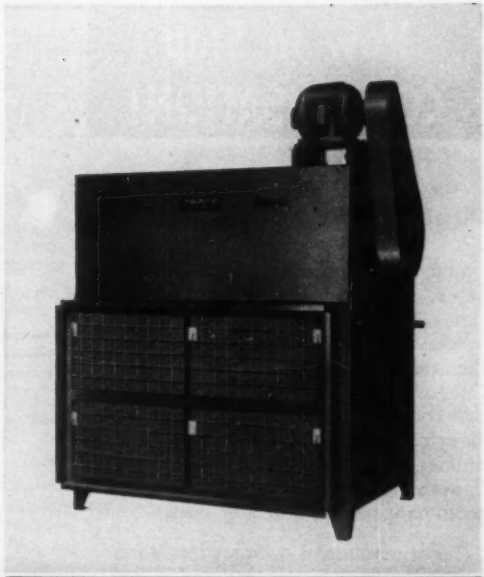
Trane Cooling Coils—For use with clean chilled water or well and municipal water or with direct expansion refrigerants.



Trane Centrifugal Fans—In Class I and II construction with backwardly inclined or forward curved wheel construction.



UniTrane Air Conditioners — Available in two styles with one, two or three fan arrangements.



Trane Climate Changers — Twenty-four standard combinations of coils, fans, humidifiers, filters, dampers, 450 to 16,250 cfm.

Trane Air Conditioning Products Serve Everywhere

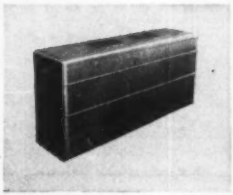
2. One Source of Supply — all products are sold by the same high-grade sales-engineers who are trained carefully as equipment consultants. They know Trane products and they know your problems of heating and air conditioning. You deal with one salesman instead of many.

3. One Set of Catalogs — you can select all the products you need for air conditioning from one catalog binder. No searching around for ratings and dimensions—no necessity for correlating ratings and sizes. Everything is contained in those big Trane binders that fit so handily at your elbow.

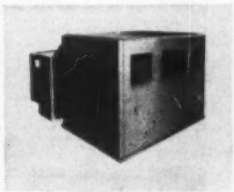
4. Complete Flexibility — all Trane products are available in a complete range of sizes and models. Regardless of your problems there is Trane equipment to fit your requirements exactly — no fitting your requirements to inflexible equipment. So flexible is the Trane line that you can create a 50-ton air conditioning system in at least 10 different ways.

More and more architects, engineers and contractors are specifying and installing Trane equipment for these reasons. Why not try the undivided responsibility of Trane Heating, Cooling and Air Conditioning Equipment on your next project?

Whatever your air conditioning problem is, look for the answer in an undivided responsibility system of matched Trane products.



Trane Custom-Air—Deluxe air conditioning system for multiroom buildings. Controls temperature and humidity separately.



Trane Multi-Zone Climate Changers—A single air conditioner that handles up to six zones in the same building.

Trane AA Air Conditioner—A compact year-around unit for the small apartment, office, hotel or tourist court.

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MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

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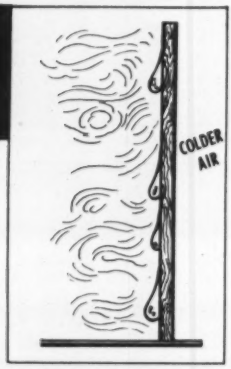
OFFICES IN 80 U. S. and 10 CANADIAN CITIES

How to Stop CONDENSATION!

Prevent Damage to Wood, Plaster, Paint, etc.



Condensation forms when temperature of contacting air is reduced below dew-point by a cold surface.

Condensation forms when the capacity of an air space at a given temperature is too small for the amount of vapor present →

As air grows colder, it can hold less vapor. Saturation increases until a dew-point is reached, and condensation occurs. The surface of a material colder than the contacting air it faces, and continuously losing heat on the other side, will continuously extract heat from the air by direct conduction. The denser and bulkier the material, the more heat will it extract and store before attaining room temperature, if it ever does.

For example, if ordinary insulation is installed with air spaces on both surfaces, it continuously absorbs and emits heat rays at a rate of over 90%. If installed without air spaces, there is even more heat flow continuously by direct conduction through solids. Each square foot contains about 363,314 fibers, with surfaces aggregating approximately 46 sq. ft. for condensation formation.

With multiple sheets of accordion aluminum, the sheet nearest the warm room weighs only ⅛ oz. per sq. ft., absorbs and emits only 3% heat; thus extracts and stores practically no heat from the air, only enough to attain and remain at room temperature. The additional reflective air spaces on the other side are insignificant heat conductors. The other sheets of aluminum and fiber block convection heat losses to the "cold" side.

No condensation forms on the aluminum surface next to the warm room, for a dew point is never reached. The sheet's other surface faces a space which is a *little* colder than the aluminum. Since warmth flows to cold in radiation and conduction, the aluminum will *give off* a *slight* amount of *heat* to the colder space, thereby slightly *increasing* its vapor retaining capacity; making condensation impossible.

The next reflective space has almost the same temperature as the next aluminum surface, with its slight mass, ⅛ oz. per sq. ft. The aluminum absorbs and emits little heat. Its other surface is slightly warmer than the air it faces; again there is no extraction of heat (the REVERSE), no dew point.

With 4 or 6 reflective spaces, there can be no dew point anywhere on or in such aluminum insulation. Should rain leak in, it will be slowly expelled as vapor, since exterior walls, in comparison to aluminum have a far greater permeability than the required minimum 1 to 5 ratio. Because aluminum is impervious to vapor flow, condensation on under surfaces of roofs and inner surfaces of outer walls is minimized.

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Wall-Heat C.073, R13.69 equals 4½" DRY Rockwool
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THE EDITOR'S PAGES

• WE'VE POINTED OUT in these pages before that the heating, piping and air conditioning contractor is a most important "man behind the man behind the man behind the gun". Before production of any military or defense equipment, the heating, piping and air conditioning services of the plant in which such equipment is manufactured must be in good operating order. . . . . Typical of projects involving old plants now being readied for defense production is a big factory in the middlewest to be used for the manufacture of radar components. Before production—before, in fact, installation of the production tools and facilities themselves—the heating, piping and air conditioning contractor is removing the old radiation and tagging it for re-installation elsewhere, installing piping for air and other services for the production lines, and putting in the new heating system. The inside design condition for the plant's use during World War II was 55 F; for the plant's new production, an inside temperature of 70 F is needed. Extensive revisions of the heating facilities are thus, of course, required. . . . Air conditioning of some areas in the plant will also be essential to efficient, accurate manufacturing. . . . Actual manufacture of defense and military equipment is done by "the men behind the men behind the guns"—but before the wheels can turn, such essential facilities as heating, piping and air conditioning must be ready to function.

NPA PUBLICATIONS EXPLAIN CMP

A BRIEF, non-technical outline of the principles and operating procedures of the controlled materials plan, which becomes operative July 1, has been published by the National Production Authority of the U. S. Department of Commerce.

The booklet, ABC's of CMP, is intended for readers having a general interest in the CMP as well as for manufacturers and others who will be directly affected by its operation. Copies may be obtained from the NPA in Washington and from Commerce Department field offices.

Regulations establishing the basic pattern for operation of the CMP were also issued last month by the NPA.

Regulation 1 defines rights and obligations under the CMP and explains how production schedules will be authorized for defense and defense-supporting manufacturing operations and how controlled materials (steel, copper and aluminum) will be allotted for completion of authorized production.

Regulation 2 sets limits on the amounts of controlled materials that a user may have in inventory.

Regulation 3 establishes the relative preference status of delivery orders for controlled and other materials needed for production of goods deemed essential to the re-armament program and the general economy.

Regulation 4 establishes rules for deliveries of steel, copper and aluminum by warehouses, jobbers, dealers and retailers.

The NPA has also issued a list of more than 4000 manufactured articles containing steel, copper or aluminum which are designated as class "B" products under the CMP.

The Official CMP Class "B" Product List shows "B" products under category headings and indicates the particular NPA industry division to which manufacturers of each should apply for authorized production schedules, allotments of controlled materials (steel, copper and aluminum), and defense (DO) ratings.

However, manufacturers of certain items on the list (those marked with an asterisk) will not be granted controlled materials allotments at present, and are instructed not to apply, except for materials for all parts to be used for repair purposes. No heating, piping or air conditioning items are asterisked.

An alphabetical listing of from 12 to 13 thousand products and materials required in all types of production has also been published. This list is coded to enable producers and consumers to identify the NPA industry division or other government agency having jurisdiction over output of each item listed.

OBJECTIVES OF CEILING PRICE REGULATION

THE OBJECTIVES of ceiling price regulation 22, issued by the Office of Price Stabilization and which became effective May 28, are to "restore more normal cost-price relationships", roll back margins "widened after the Korean outbreak", and grant "needed relief" to manufacturers from the general price freeze order.

The regulation sets ceiling prices for many manufactured products at a pre-Korean base plus actual increases in materials costs through 1950 (later for some goods) and increases in factory payroll costs through March 15, 1951.

The base period is April 1 through June 24, 1950, or any one of the three preceding calendar quarters.

Ceiling price is the highest base period price of a commodity, with adjustments for factory payroll and materials cost increases.

Sales terms must be wholly consistent with base period delivery terms, differentials for purchaser classes, discounts, premiums, etc.

CPR 30, also effective May 28, is a companion measure to CPR 22. It covers machinery and related manufactured goods, including air conditioning equipment of 25 tons capacity and over.

SOME AIR CONDITIONING EXEMPTED FROM M-4 ORDER

A LIBERALIZATION OF construction limitations as given in the National Production Authority's M-4 order was included in an amendment to the order issued early last month. The amended order exempts certain installations such as "box type air conditioning units", says the NPA, by the phrase which exempts "installation of personal property, fixtures or equipment where the total cost incurred for installation in any consecutive 12-month period does not exceed $2000."

The same amendment now requires NPA authorization for construction of large apartment houses, "luxury" residences, and all industrial facilities and public and private construction projects which require the use of more than 25 tons of steel.

Construction projects for which sites had been cleared before the date of the original basic construction order and its amendment may now be authorized to proceed, according to an explanation of the construction order amendment by the NPA.

NPA said the explanation was required because the May 3 amendment to order M-4 substantially changed the definition of the term "commence construction." In the amended order, "commence construction" is defined to mean "substantial site clearance (including demolition of buildings or structures) . . .".

Many persons had cleared sites preliminary to starting an actual construction project before October 25, 1950, the date of the original order which banned construction for amusement, recreation or entertainment, or January 13, 1951, date of the amendment requiring NPA authorization for most commercial construction, NPA said.

NPA announced, therefore, that application may now be made to NPA for permission to go forward with any project on List A (prohibited construction) where substantial site clearance was done before last October 26; or any project on List B (construction requiring NPA authorization) where substantial site clearance was done by January 13.

These applications, NPA asserted, should be documented to a degree that will enable NPA to determine whether the alleged site clearance was substantial and whether it was actually preliminary to a bona fide building project then contemplated to go forward to completion.

If the application clearly demonstrates these facts, NPA said, specific authorization to proceed with the project can be issued.

ASTM CONSIDERS CHANGES IN PIPING SPECS

AMONG THE ACTIONS taken at the midwinter series of meetings of the American Society for Testing Materials committee A-1 on steel was an appeal to set up emergency alternate provisions permitting higher phosphorus in certain alloy standards for pipe and tubing; the incorporation in virtually all the pipe and tube specifications of a range of check analyses for chemistry; approval of new specifications on seamless and welded tubes for low temperature service; a new system of grade designations to apply to all of the specifications and bring better order in this respect; and the addition of new grades of low metalloid ingot iron in the specification A 253.

The producers who must use scrap which may be high in phosphorus stressed the necessity for emergency action in raising the permissible limits so that more efficient use could be made of alloy steel for products such as still tubes, boiler tubes, both seamless and welded, and austenitic seamless and welded tubing for general, sanitary and refinery service. While ASTM has not renewed its procedures so widely used during World War II involving emergency specifications and alternate provisions, a somewhat similar plan is expected. This involves the issuance of "pink slips" which can be affixed to the specifications, and also includes publication of the complete provisions or notice in the ASTM Bulletin.

In the steels affected, it is proposed the present phosphorus limits of 0.030 be raised to 0.045 percent as an emergency measure.

The new tentative for low temperature service will cover seamless and welded carbon and alloy material. Three ferritic grades are provided, a carbon steel and two for nickel-silicon. Reference is made to austenitic grades which are suitable where Charpy impact values of 15 ft-lb minimum are required. Rather rigorous requirements are incorporated and, in addition to chemical composition and tensile properties, the material is subject to flattening, flaring, hardness, impact, and hydrostatic tests. This new *tube* specification will be a companion standard to one recently approved for Pipe for Low Temperature Service A 333.

On grade designations, the committee proposes to substitute for the current not-too-clear "T" numbers a new system which will use the carbon, molybdenum, chromium or other major alloying element as the key. For example, grade CMB would be the present low carbon-molybdenum grade; grade CR 2¼ would be the 2¼ chromium steel and CR9 would be the nominal 9 percent chromium alloy.

There was also considerable activity on properties and tests of valves, flanges and fittings for use at both elevated and for low-temperature service. Work will continue on proposed standards covering austenitic type welding fittings and also on steel castings for low temperature service. New requirements for austenitic steel castings for service at elevated temperatures and pressures were approved. In the standard covering Forgings for Flanges and Fittings, A 182, the current 1 percent chrome grade will be modified to the more popular 1½ percent composition. A new grade of austenitic steel, Type 304, is to be added to both the high and low temperature bolting specifications. In the Nut Specification, A 194, two grades of nickel-chromium steels using selenium and titanium for free machining and stabilizing will be added.

Among the recommendations affecting pipe for service at elevated temperatures were the approval of check analysis ranges in several specifications, more precise definition of "heat-treated lots", and decisions to develop new standards covering fusion welded alloy pipe, which involves heavy wall thicknesses and sizes; and also to consider a specification for centrifugally cast steel pipe in the ferritic grades. The latter study will parallel similar work involving the austenitic grades.

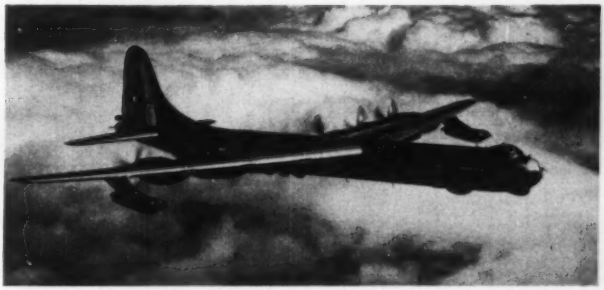
The action calling for emergency increase of the permissible phosphorus limits from 0.030 to 0.045 percent was asked in the Alloy Pipe Specifications A 158 and A 312. A study committee was set up to coordinate the various grade designations used in the family of specifications covering castings, pipe, welding fittings, forgings, and bolting.

For a period of two years, the wedge test, as a supplement to the tension test for determining the mechanical properties of quenched and tempered steel bolts, Specification A 325, has been under consideration. A revision has been agreed upon using the wedge under the head of the bolt as a means of assuring a properly headed bolt.

G.E. EMPLOYEES FIND THAT IDEAS PAY

IDEAS PAID OFF to the tune of $375,000 for General Electric Co. employees during 1950. This total represents the amount paid by the company for 22,275 suggestions, which were adopted from 65,628 submitted by employees during the past year under the suggestion award program. Of the suggestions submitted, 33.9 per cent were used.

Air Conditioning HELPS TO GET 'EM Into the Air!



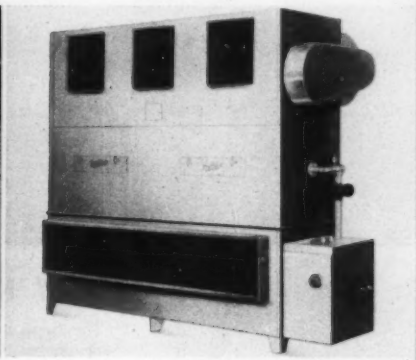
B-36D, Courtesy Consolidated Vultee Aircraft Corporation, whose Ft. Worth factory uses many Buffalo Air Conditioning Units.

Modern warplanes are marvels of intricate mechanism—and conditioned air helps make them possible. The hundreds of designers, tool makers and production workers who play a part in making a plane, do their work better because of conditioned air. Precision aircraft parts, such as instruments and optical and electronic equipment, were made under optimum atmospheric conditions. All textiles, such as the pilot's clothing, were made in atmosphere of exactly controlled humidity, temperature and dust content.

Every essential industry is putting air conditioning to work in *many* ways. And in every industry, you'll find "Buffalo" Air Conditioning Units doing their jobs well—air washing, heating, cooling, controlling humidity, ventilating. Their reputation for reliable performance, easy maintenance and long life comes from over fifty years in the business of air conditioning. Some of the original "Buffalo" Air Washers are still in active service.

FOR *EXACT* RESULTS, SPECIFY "Buffalo" AIR CONDITIONING UNITS

All-weather comfort conditioning is provided by this "Buffalo" unit, whose air supply is from the "Buffalo" Limit-Load Fan at left. WRITE FOR BULLETINS 3703 and 3181-B.



"Buffalo" Evaporative Coolers are ideal for cooling liquids for air conditioning, Diesel cooling, etc. WRITE FOR BULLETIN 3666.

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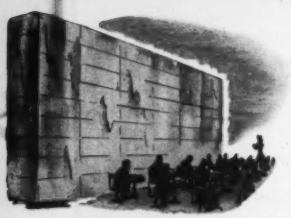
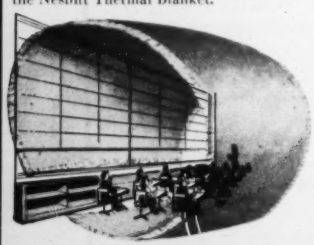
Answers the "WALL-OF-ICE" Problem

NESBITT Syncretizer with WIND-O-LINE



Large windows become a "wall-of-ice" on very cold days—unless shielded by the Nesbitt Thermal Blanket.



ONLY NESBITT GIVES YOU THIS "THERMAL BLANKET"

The trend toward larger areas of fenestration in the modern schoolroom makes greater demands of the heating and ventilating unit. The "thermal blanket" provided by the Nesbitt Syncretizer adequately shields occupants against the window "wall-of-ice" in normal situations; but under conditions of extremely long glass exposure and very low outdoor temperatures, an "extra blanket" is called for. Nesbitt WIND•O•LINE meets such needs.

When specified as an auxiliary of the free-standing Nesbitt Syncretizer, WIND•O•LINE consists of finned-tube radiation in an attractive grilled casing. It is located just below the windows and extends from both ends of the Syncretizer unit ventilator for the full length of the sill, as pictured above. It is controlled in cycle with the Syncretizer to give heat—when required—where heat is needed.

WIND•O•LINE is also available with The Nesbitt Package, recessed in a channel at the rear of the storage units . . . but it is not necessary to install storage cabinets to get this extra protection. WIND•O•LINE is yet another Nesbitt innovation which permits more of America's schools to enjoy the *new standard of classroom comfort.*

The Nesbitt Syncretizer UNIT VENTILATOR

MADE AND SOLD BY JOHN J. NESBITT, INC., PHILA. 36, PA. • SOLD ALSO BY AMERICAN BLOWER CORPORATION

• How's ABOUT expressing your views on one of the articles in this month's issue of HPAC, for publication in these pages? Your comment on a controversial point, or additional information based on your experience, would be of interest and help to others. Or perhaps you'd like to say a little on some other matter of importance to plant engineers, building engineers, heating, piping and air conditioning engineers or contractors? We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are invited to participate. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

TAKES COMMON-SENSE TO SAVE FUEL

I HAVE READ the article published in the May HPAC on How Boeing Saved $100,000 in Cost of Heating. This is a very well prepared and readable article, and illustrates what I have often said about fuel saving—it usually takes some man with the know-how who is determined to eliminate the leaks and has the authority to do it. There is no magic formula—just a lot of hard work and detailed study in the application of common-sense to elimination of leaks.

One thing that occurred to me that might be criticized by HPAC's readers, since many of them are engineers with more or less exacting minds, is that the headline says Boeing saved $100,000, but the article says $85,600 was saved. In other words, if the fuel saving was $100,000 and the additional labor was $1200 a month, the saving is $100,000 less the cost of additional labor.—E. A. TYLER, Manager, Building Dept., First Service Corp., and Member of HPAC's Board of Consulting and Contributing Editors.

PUT OXYGEN SHUTOFF VALVES ON EACH FLOOR

IN MY COMMENT on the matter of oxygen piping services in hospitals, I said that I believed that one of the agencies is preparing a safety recommendation report which includes the provision that oxygen section shutoff valves be bronze bodied, diaphragm type, double seating valves.

I believe this same agency will recommend that section shutoff valves be provided on each floor of the hospital to control the service outlets on that floor.

Some systems have been laid out with risers running up from the basement, in the walls, and taking off two outlets on each floor. A section shutoff valve is provided at the bottom of this riser but, in the event of fire or accident in the room, such valves would not be readily accessible, and, after the hospital had been in operation for a number of years, it is very doubtful whether, in an emergency, these valves could be located in time and it thus would probably be necessary to shut down the whole system.—ALBERT E. MCKEE, President, Oxygen Equipment & Service Co.

SUN ANGLE CALCULATOR A "WELCOME TOOL"

THE SUN ANGLE calculator described in the April HPAC by Donald W. Dunipace is a most welcome tool for those who need to estimate solar heat gains. Although the tabular transmittance and heat gain data given in the booklet accompanying the calculator apply only to windows of flat glass, the device and the nomographs offer accurate means of calculating sun angles and solar irradiation necessary for estimating heat gain through other building sections.

A similar though less flexible calculation aid prepared by the industrial welfare division of the Australian Commonwealth Department of Labor and National Service recently came to the writer's attention. It is intended as a tool to solve problems of sunlight control by determining depths of penetration and areas of solar irradiation. This agency has also prepared design data on fixed horizontal sunbreaks for the important cities of Australia.

In recent years, the ASHVE Journal Section, which appears each month in HPAC, has contained ASHVE research reports giving new data on solar heat gain through flat glass, glass block and configurated glass of various types and combinations. The problem of presenting experimental data in the form of easy-to-use tables is a formidable one. Not only is the calculation work lengthy and tedious by conventional trigonometry, but also the space available for publishing the completed tables is severely limited. So far, it has only been possible to prepare tabular data for one date, three latitudes and eight orientations (see the 1951 ASHVE Guide, Chapt. 12).

The simplicity and universality of the sun angle calculator described by Mr. Dunipace facilitates the application of much new data, such as that given in Heat Flow Through Unshaded Glass: Design Data for Use in Load Calculations. This paper appeared in the June 1950 ASHVE Journal Section. The time-saving features of the calculator should encourage the engineer to calculate rather than to guess at solar heat transmission for the many problems that cannot be covered by the relatively few data tables now available.—GEORGE V. PARMELEE, Research Associate, ASHVE Research Laboratory.

TROUBLE WITH AIR IN HEATING SYSTEM

I HAVE READ with interest the question raised by a New Zealand reader, and the reply given by Samuel R. Lewis on page 103 of the November 1950 HPAC. The question was as follows:

"We have been experimenting with closed central hot water heating. Our systems operate on the two pipe system with a correctly sized expansion vessel. We use galvanized iron piping and either cast iron or steel radiators. We operate on tempera-

tures of from 200 to 220 F. We have considerable trouble with accumulations of air in the top parts of our radiators. Some of the 'air' appears to contain a large proportion of hydrogen gas.

"We would like to know whether other engineers have similar troubles. We would also like to know what means are taken to overcome them."

A significant point in the query is that the "air" appears to contain some hydrogen. Care should, of course, be taken to insure the necessary air vent valves, etc., as Mr. Lewis suggests. It is possible, however, that the large amount of gas which collects may be due to electrolytic action. There may be some electrolytic action occurring between the galvanizing and metal of the pipe wall. This will occur particularly if the water contains a high proportion of dissolved solids. In the presence of caustic soda or sodium carbonate at temperatures of 200-220 F, it is likely that zinc will dissolve and produce hydrogen or CO_2.

It is suggested that the reader who asked the question should:

a) Make an analysis of the water in the system to insure that the alkali or acid content is not excessively high.

b) Examine the heating system to see if excessive corrosion is occurring in any particular part.

c) Remove from the system any dissimilar metals as far as possible.

I have come across one or two such cases in my experience. They require investigation as severe corrosion problems may be occurring. —G. F. J. MURRAY, Combustion Engineer, Anglo-Iranian Oil Co., London, England.

AIR RAID SHELTERS NEED VENTILATION

HOWARD C. MURPHY is to be complimented for his excellent article on Ventilation of Survival Areas for Civil Defense, published in the May HPAC. As he indicates, outside air is not necessary for short-term ventilation if the shelter is not densely populated. However, he also states that shelters should be designed for 500 lb per sq ft pressure. Structures of this type are expensive and can only be justified when densely populated or when housing some vital operation. In order to effectively and economically utilize personnel shelters, outside air is required for ventilation for any prolonged occupation involving considerable personnel.

Also, absolutely airtight construction is very difficult and impractical to obtain. Some leakage is inherent, especially when the structure is subjected to unusual temperatures and pressures. The leakage can be overcome by internal pressurization with purified atmospheric air, which also serves to overcome vitiation.

When air vents to the atmosphere are used, back pressure valves designed to withstand up to 500 psi would be required for protection against heat and blast. This is especially necessary where paper filters are used on air supplies, as these are readily punctured by a sudden increase in pressure.—WARREN VIESSMAN, Director, Heat & Power Div., U.S. Naval Civil Engineering Research and Evaluation Laboratory.

NEVER MISSES SAM LEWIS' PAGE

I ALWAYS ENJOY Sam Lewis' Page each month in HPAC because he always writes about something interesting, and I would feel that there would be a possibility of missing something important to my work if I failed to read it. In other words, it is pure selfishness on my part that makes me read his "Page". The May "Page" is no exception, and it should be "must" reading for all consultants, both young and old.

I wish he had pointed out one more important and desirable quality required of a good engineer — the ability to approach each job with an open mind so that he can give the owner the proper system required by the process or building instead of trying to change the pattern of some old job so that it can be fitted to the new problem and thus save some study and what some engineers erroneously consider as wasted or non-productive effort.

Mr. Lewis has pointed up the ever-increasing air conditioning problem of higher heat loads from either the sun or lights, and I was intrigued by his solution for the art museum. I was glad to see him lend his voice to the too few other voices that have been stressing the inevitableness of panel cooling for removing light and sun loads. When both Mr. Lewis and Charles S. Leopold point this out (see his paper in the ASHVE Journal Section in the May HPAC), we know it is feasible and practical.

Mr. Lewis' reference to the use of reheat in air conditioning systems touches a sore spot in our industry, for we suffer from copious quantities of lack of information regarding methods of control of air conditioning systems — especially with reference to true economical operation (of which satisfaction is part). I wonder if we couldn't persuade Mr. Lewis to devote a series of his "Pages" to this problem, and thus throw some light on a dark subject?

I think the most important lesson we can gain from the general tone of Mr. Lewis' remarks is that we should freely use ingenuity if we want to be successful as engineers.—ARTHUR J. HESS, Hess, Greiner & Polland, Inc.

BIG SAVING FROM SCRAP CONSERVATION

A SCRAP CONSERVATION program at the Westinghouse Electric appliance division plant, Mansfield, Ohio, has added to production and produced a saving estimated at $1.5 million a year, according to J. H. Ashbaugh, vice president.

Vital materials such as copper, aluminum, brass, nickel and steel — all made scarce by the nation's military program — are being culled from the division's appliance producing lines daily. Some of the material is reprocessed for further use; stamping methods are changed to stretch scarce steel; plating processes are improved to stretch copper and nickel supplies.

Back of the ability to produce dollar savings and the ability to stretch materials is the division's salvage department.

Over 160,000 gal of paint has been recovered by using water wash paint spray booths which collect excess paint that might otherwise be lost. Such paint is reprocessed and is suitable for many production operations.

"QUOTE"

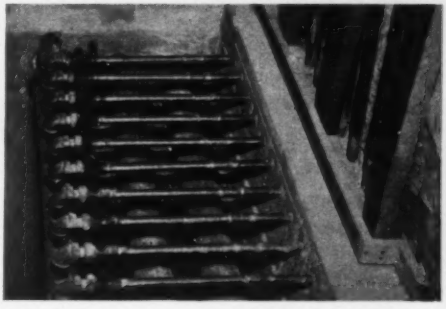
"Do not install or operate before reading instructions." — *from the nameplate on a 29,000 hp electric motor, one of three driving a huge axial flow compressor delivering air to a supersonic wind tunnel.*

RAVENSWOOD PRESBYTERIAN CHURCH
Chicago, Ill.

(Below-Top) Section of radiant panel heating system before concrete was poured. 16,500 ft. of ¾"; 2,000 ft. of 1¼" and 1,500 ft. of 1½" Revere Copper Water Tube were used. Architect and Engineer, Benj. Franklin Olson; General Contractor, Harry C. Bjorklund & Son; Revere Distributor, The Davies Supply Co., all of Chicago. Harden Heating & Air Conditioning Co., of Elmwood Park, Ill., was Heating Contractor.

(Below-Bottom) Shows arrangement of balancing cocks on a return header. System was designed for zone control, a most important requirement for efficient operation in this type of edifice.

ANOTHER CASE OF *COPPER where it counts!*



CHURCHES, schools, colleges, municipal, office and similar buildings must be built to last. It's the only way to make them pay. That's why you'll find enduring materials like copper, brass and bronze used in so many places in so many of them.

The lasting quality of Revere Copper Water Tube was one of the reasons for its being used for the radiant panel heating system in the Ravenswood Church. Revere Copper Water Tube is non-rusting. It costs no more for workmen to install because its 60′ lengths are easy to bend and handle . . . it requires fewer fittings than rustable, short-lived materials. What joints are necessary are permanently soldered in a jiffy. That's why more and more architects, engineers, builders and contractors have been using it where it counts.

Although copper tube cannot now be used in civilian installations of radiant panel heating, we cite the Ravenswood Presbyterian Church to remind you of the merits of Revere Copper Water Tube over other materials so that when copper is once more permitted you will again use it. Meantime remember, you can still use Revere Copper Tube in underground service lines, domestic hot and cold water supply lines, industrial processing and for gas equipment.

Revere Copper Water Tube is available in hard and soft tempers in straight lengths; also in 60′ coils in soft temper. Each length is marked with the Revere name. Look for this mark. It assures you of uniform quality. These materials are available through your Revere Distributor, who will also put you in touch with Revere's Technical Advisory Service in the event you wish to discuss your technical problems.

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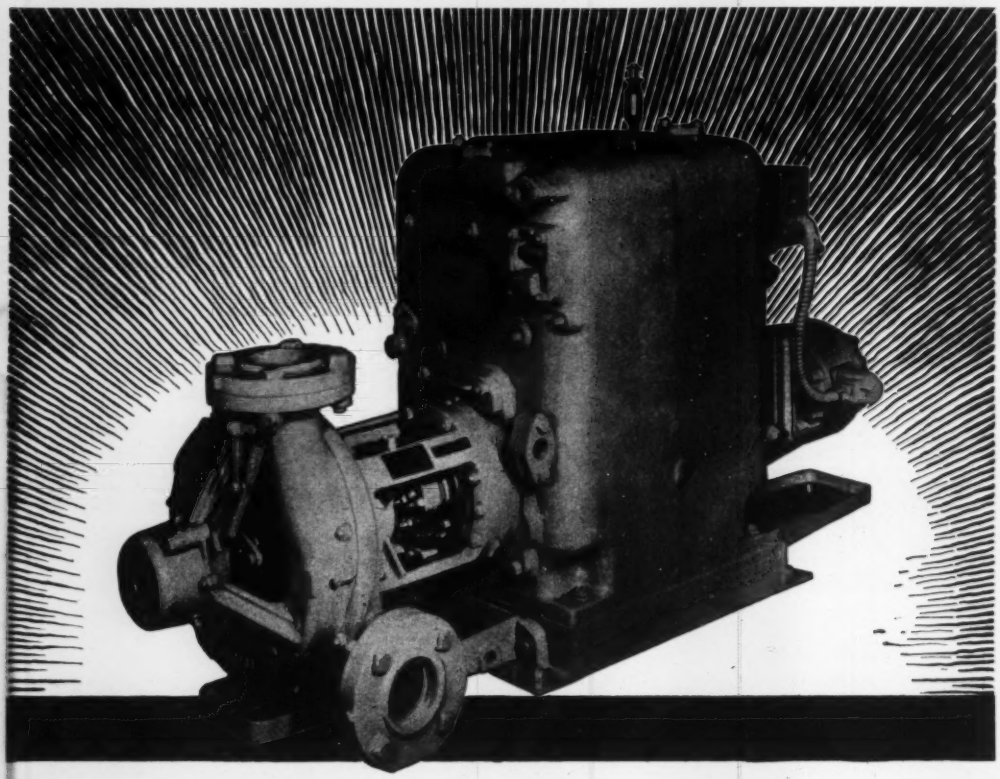
Safety!

THE NASH VAPOR TURBINE HEATING PUMP IS NOT STOPPED BY ELECTRIC CURRENT FAILURE



For service in greenhouses, hospitals, schools, theatres, and public buildings, where heat failure is a serious matter, the Nash Vapor Turbine Return Line Vacuum Heating pump should be specified, for this pump operates perfectly without electric current.

This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the Vapor Turbine is returned to the system for heating, with little heat loss.

This pump insures constant heat in the system, it eliminates electric current cost, and it promotes high efficiency in the heating system. Heating efficiency is due to the fact that this pump can operate continuously with economy. Continuous operation means uniform circulation, and uniform conditions in the system mean steam saving.

This pump has but one moving part, no internal wearing parts, and requires no internal lubrication. Bulletin D-246 tells all about it, and it is free on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

Air Conditioning Hot Lab at Brookhaven Atomic Pile

With the rapid increase in the use of radioactive isotopes in industrial and medical research, the designer of almost any laboratory or hospital may have to contend with protection from radioactivity. Properly designed and operated air conditioning and ventilating services are essential for this purpose. The experience reported here obtained at the Brookhaven National Laboratory provides a useful guide for future laboratories

By James D. Wolcott

The H. K. Ferguson Co.

Industrial Engineers & Builders

IN DESIGNING and constructing the recently completed hot lab at the Brookhaven National Laboratory in Upton, N. Y., engineers, scientists and contractors encountered and solved problems which may confront future designers and installers of similar facilities.

With the rapid increase in the use of radioactive isotopes in industrial and medical research, the designer of almost any laboratory or hospital may have to contend with protection from radioactivity. Here, especially, experience gained in designing the hot lab may provide a guide for others.

The hot lab provides facilities for experimentation with "hot" materials — radioactive isotopes made by bombarding stable isotopes with neutrons in the Brookhaven atomic pile. The isotopes are used as tracers to reveal new information about chemical and biological processes.

The hot lab was to provide complete facilities for carrying on research of this kind in complete safety. Two scientists who were to be in direct charge of the lab set up basic design criteria to guide engineers of The H. K. Ferguson Co. The scientists, Louis G. Stang, supervisor, and Gerald Strickland, another member of the lab staff, and the engineers cooperated closely to translate these standards into a laboratory which may well serve as a model for future "hot" facilities.

Three Major Areas

Measures to prevent contamination played a large part in establishing the layout of the building. The building is thus divided, according to the degree of radioactivity to be accommodated, into three major areas, (1) hot, (2) semi-hot, and (3) cold. As a corollary of this principle, the direction of air flow is from cold to hot areas. This ever-present problem of contamination was responsible for the careful design of the air conditioning and ventilating and for the unusual features embodied in the system.

To guide the design program, these basic requirements were established:

1) Division of space into zones according to degree of radioactivity.

2) Maintaining the general air flow from cold to hot areas.

3) An exhaust system especially equipped with hoods, filters, blowers, scrubber towers and controls to prevent escape of radioactive material to the atmosphere.

4) The use of 100 percent outside air for ventilating and air conditioning, completely avoiding the use of recirculated air.

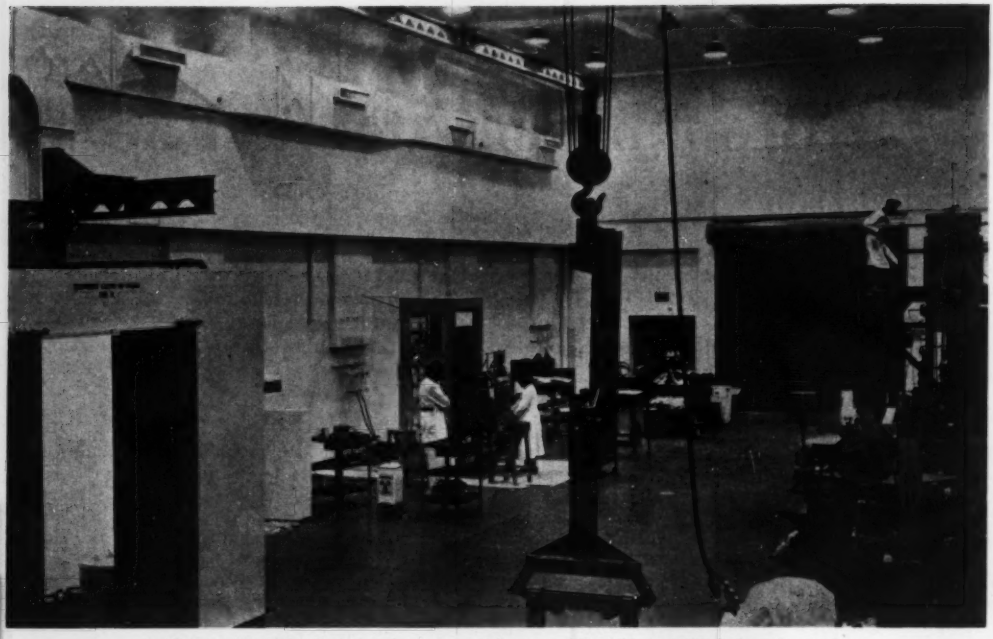
In completely air conditioned areas, design temperatures were established at 70 F in winter with 35 percent relative humidity wherever possible. In the counting room, however, 50 percent relative humidity is maintained throughout the year. In the summer, room temperatures vary from 72 to 80 F as the outdoor temperature varies from 75 to 95 F and the relative humidity is kept at 50 percent. In these areas, all heating is accomplished by tempering the air introduced into the rooms. Convectors and radiators were not used because of stringent cleanliness requirements.

All other areas are mechanically ventilated with filtered air supplied at 70 F in winter and at outdoor temperature in summer. In many cases, heating of unconditioned areas is augmented by convectors or radiators.

Equipment for conditioning and tempering air is for the most part conventional, except for certain features to be described later. In general, the conditioning equipment consists of fans, dry type filters, preheat and reheat coils (supplied with 5 psi steam), sprays and cooling coils for humidifying and dehumidifying (supplied with chilled water from a 200 ton centrifugal refrigeration machine) and necessary controls.

Air Supply for Hot Area

The hot area of the laboratory is completely air conditioned by two units, one delivering 15,500 cfm and the other 5020 cfm. The first supplies the huge high ceiling room where the hot cell semi-works area and handling equipment are located. In addition, approximately 10 percent of the total capacity is temporarily delivered to an area allotted to future semi-hot cell installation. The 5020 cfm unit splits into four branches just downstream of the fan. Each



SEMI-WORKS AREA is designed to accommodate assembly of big experimental equipment in the hot lab at Brookhaven. Along the ceiling is a duct for supplying conditioned air to this part of the building. All service piping is specially jacketed and the floor is covered with special plastic tile to facilitate decontamination

branch has its own booster heater for separate zone temperature control. The areas served by this unit are:

1) Five semi-hot laboratories (1500 cfm total) and pneumatic tube room (100 cfm).

2) The corridor adjacent to the semi-hot laboratories (1200 cfm).

3) Four equipment repair rooms and one hot storage room (1020 cfm total).

4) Decontamination area (1200 cfm). The exhaust for this area is discussed later.

Cold Area Partially Conditioned

The cold area is only partially air conditioned — in the analytical lab, process development lab, physical measurements lab and counting room. Three systems serve these spaces. The first delivers 1350 cfm to the physical measurement and counting room; air from these rooms is exhausted to the adjoining corridor. The second, called the lab constant supply, delivers a constant quantity of 1800 cfm each to the analytical lab and process development lab. Since each of these labs contains four hoods and each hood is equipped with its own 1000 cfm blower, a make-up supply air is required to insure proper temperature and humidity conditions when more than two hoods are operating. To satisfy this condition, a third unit — the lab variable supply — furnishes up to 1800 cfm make-up for each of these rooms. The proper amount of air required is obtained by automatically controlled vortex dampers in the supply. The total exhaust exceeds the total supply in each room by 400 cfm. This relatively small quantity is drawn from the corridor to maintain the air flow into, rather than out of, the lab.

Since experiments involving materials of little or no radioactivity will be done in these labs, the air from the hood is filtered through CWS (Chemical Warfare Service) filters and discharged directly to the atmosphere.

The remainder of the cold area is for the most part supplied with unconditioned air with the exception of offices in the lower level, which are heated by convectors. All other outside rooms are supplied with ventilation air and are additionally heated by convectors. The air supply is delivered by one unit of approximately 20,000 cfm capacity. Most of this air is exhausted by several small fans serving such spaces as locker rooms, toilets, a tool room and a mechanical equipment room, where leakage from these areas to other parts of the building would be undesirable. Air supplied to this area exceeds the total exhausted through cold area blowers by 4670 cfm.

Positive Flow from Cold to Hot Areas

One of the unique features of the system is the control of air to maintain a positive flow from the cold to the hot areas, thus preventing the possibility of contaminated air infiltrating back to the cold area. Normally, the room air in the hot area does not contain activity of a level dangerous to personnel. This precaution is taken, however, because of the possibility of accidental spillage or exposure of highly radioactive material to the working area.

This directed flow is achieved in three ways. First, a slight positive pressure is normally maintained in the cold area by supplying more air than is exhausted. Second, more air is normally exhausted from the hot area than is supplied to it. A flow of air in the proper direction is thus achieved.

If, however, a reversal of flow should occur (for instance, a noticeable reduction in the amount of air exhausted from the hot area), a third means is used to assure the proper direction of flow. This is the static pressure regulator, which controls four 5500 cfm ventilator fans on the roof of the hot area. Should the differential pressure between the two areas fall below a certain point, the regulator actuates one or more fans according to demand. Except for an occasional brief opening, outside doors of the laboratory are kept closed. This holds the intake of outside air to a minimum and makes control more effective.

Noncorrosive and Corrosive Exhausts

Air in the hot areas is exhausted mainly through the hoods, supplemented by smaller exhausts through drains and other locations where contamination exists. The exhaust air is divided into two systems, one containing acid fumes and the other free of acid fumes. This separation meant that only one system needed to be fabricated from acid and corrosion resistant materials.

Air containing acid fumes is neutralized chemically by passing it through a group of caustic scrubber towers. From the scrubbers the air is drawn through two CWS filters placed in parallel. These filters can remove particles as fine as 0.1 micron. After passing through the filters, the air is drawn to the base of the main 325 ft concrete stack by a stainless steel fan. In reaching the stack the air passes through a 250 ft underground stainless steel duct, 14 in. in diameter. The 14 in. duct is strapped to the inside of the concrete stack and runs all the way to the top before discharging its air. This was done to prevent any possible corrosive action on the stack lining.

The second system, handling air of a noncorrosive nature, draws air mainly from room and hood exhausts. This air is also passed through CWS filters to assure the removal of all radioactive particles. An underground duct of precast concrete pipe carries this air to the fan house at the base of the main stack.

Air from the hot area is exhausted from these points:

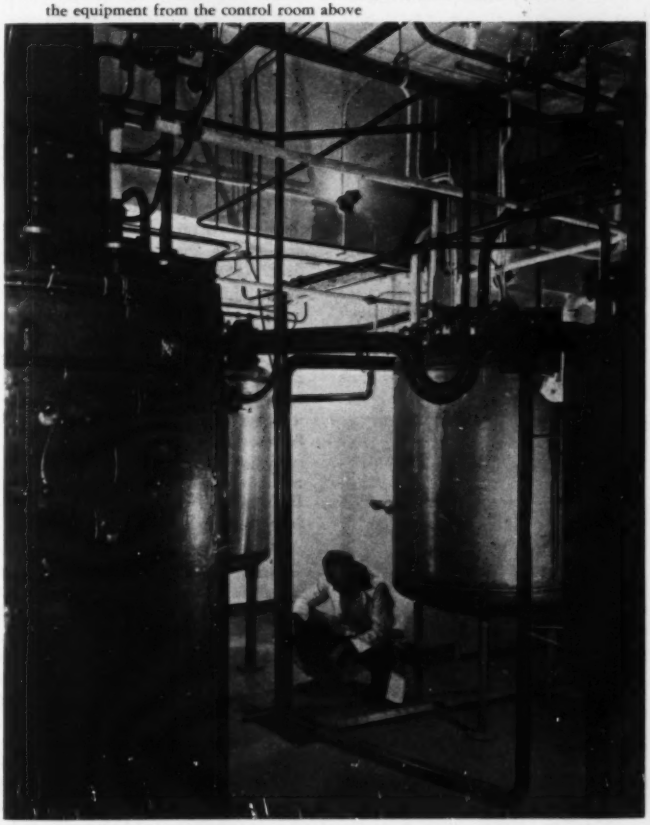
1) The hot cells.
2) The semi-hot cells.
3) The equipment repair rooms and the hot storage room.
4) The semi-works area.
5) The decontamination area.
6) The pneumatic tube room.
7) Roof power ventilators (Used only as auxiliary exhaust to effect negative pressure as previously described).

Stainless Steel Centrifugal Fans

The hot laboratory fan house contains two non-acid axial flow fans of 15,000 cfm capacity each, two stainless steel centrifugal fans for corrosive air with a capacity of 2500 cfm each, and a 50 kw gasoline generator to supply emergency power to the fans. The fan house also contains switchgear, control panels and a monitoring station for checking the level of radioactivity in air passing through the two systems.

The two acid fans are installed in parallel, and each has a motorized suction butterfly valve and a manually operated discharge valve (normal-

ELABORATE NETWORK of pipes and tanks is necessary for control of radioactive liquids resulting from experiments with radioisotopes. This waste treatment area cannot be entered while lab is in full operation, because of radioactivity of materials in the tanks. Only during a long shutdown for repairs, when radioactive materials have been pumped out of tanks and pipes, can personnel safely re-enter the area. For day-today operation, instruments detect leakage, and periscopes permit remote inspection of the equipment from the control room above



ly open on both fans). Only one fan normally operates at one time, the other being a standby controlled so as to cut in automatically in case of mechanical failure of the operating fan. The static pressure of each of these fans is 20 in. of water. One of these fans operates at any time experimental work is being carried on in the area served by this system.

The two non-acid fans are also in parallel, much in the manner of the acid fans, except that each non-acid fan is equipped with a motor operated inlet vane rather than a motorized valve. These fans are fully automatic in operation. For the most part, one fan is sufficient to handle the normal load but there are times when both fans are required.

The prime controlling device for this system is a static pressure regulator located in the hot area and which has a pressure tap in one of the non-acid exhaust duct branches.

From a safety standpoint, a pressure lower than atmospheric should be maintained in all branches of the exhaust system within the laboratory. The regulator is thus set to transmit a signal to the fan control panel whenever the pressure differential falls below 0.5 in. of water. The control panel, operating through a system of interlocking relays, starts up the second fan and sets its inlet vane at the proper point to meet this demand. In a similar manner, the process may be reversed on a decrease in demand.

HOT "CAVE" WHERE ATOMIC RAYS will bombard eggs containing chick embryos. The experiment is part of a study of the effects of radiation on infectious processes

The non-acid fan and the acid fan discharge into a 36 in. mild steel duct and a 14 in. stainless steel duct, respectively. These ducts run horizontally for about 20 ft, then enter the bottom of the main stack. The non-acid line extends vertically for about 15 ft, discharging its load into the main air flow. The 14 in. line, however, goes all the way to the top.

Hot and Semi-Hot Cell Ventilation

Each of three hot cells, where experiments of the highest level of radioactivity are conducted, is ventilated with 30 cfm of air drawn from the room. It passes from the cell through an orifice into a 4 in. stainless steel drain (one of five drains leading from each hot cell). This drain also serves as a duct to conduct the air to a system of caustic scrubber towers where iodine is removed and acid gases are neutralized and subsequently filtered.

Each of the five semi-hot cells is ventilated in two ways. The greater amount of air drawn into the hood from the room is exhausted at the rear of the hood through a CWS filter at the rate of approximately 1200 cfm. Each cell is exhausted by a 2 hp centrifugal blower located on the downstream side of the filter and discharging into a non-acid branch duct. These filters and blowers are housed in a separate room adjacent to the cell. In addition to this system, the cell is also vented at the rate of approximately 40 cfm through a 3 in. stainless steel drain leading from the table of the hood. Since it contains a high concentration of fumes, this exhaust air is treated in the same manner as the hot cell vent.

Filters in Series For Semi-Works Area

The semi-works area contains eight stations where special experimental apparatus may be set up. Each station is equipped with several special drains and two ducts for ventilation purposes. One duct carries off the greater part of the air, which is then drawn through a roughing filter and a CWS filter in series by a 2 hp, 1200 cfm blower and discharged into the non-acid exhaust system. The purpose of the roughing filter is to remove relatively coarse matter (such as dust), thus prolonging the life of the more expensive CWS filter.

These filters and blowers are located in a separate area where they can be serviced without interfering with the continuity of experiments in the semi-works area.

An additional 4 in. stainless steel duct is also provided at each station for drawing off fumes generated by the experiment. These ducts are eventually manifolded and carry the gases to the scrubber tower.

The decontamination room is vented at the rate of 1000 cfm, the exhaust passing through a roughing and a CWS filter in series directly to the acid-off-gas line. In this case, the scrubber towers are bypassed because of the low concentration of the fumes.

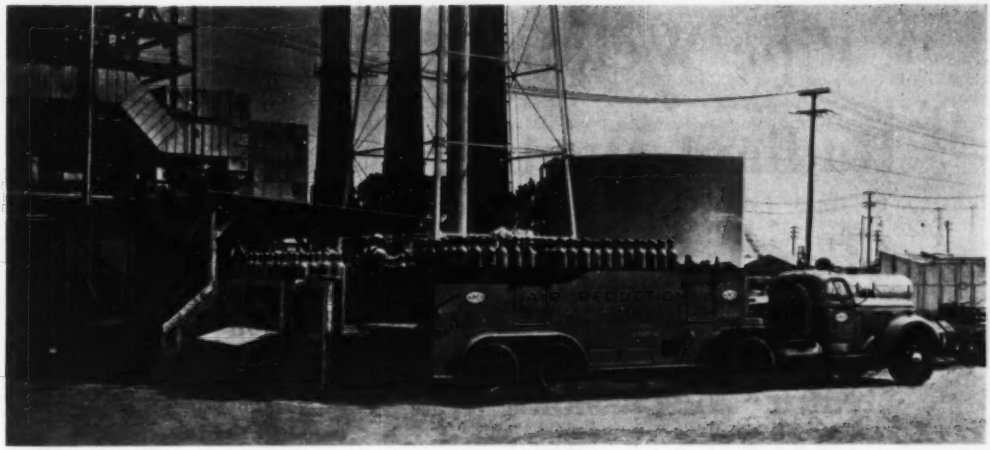
Complex Piping for Waste Disposal

One of the major problems in a laboratory handling radioactive material is the disposal of waste. A very complex system of tanks, tank cells, piping and control is required for the storage and treatment. The radioactive nature of the materials involved makes proper ventilation of such a waste system of prime importance.

In the waste treatment area, 3700 cfm of unconditioned air is supplied to the main operating area at 70 F in winter and at outdoor temperature in summer. Some of the air is drawn through the tank cells, moving from the coldest to the hottest tanks. For ventilation purposes, other portions of the supply air are removed through the scrubber tower cell and the filter and blower pit area.

All of the air exhausted from the waste area is filtered, except that removed from the filter and blower pit. In both cases the air is discharged into the non-acid systems. All tanks and most of the drain lines are vented through the scrubber towers into the acid-off-gas system.

The greater part of the hot lab process tanks, process piping, drains and acid duct work (ordinary service piping excepted) is constructed of type 347 columbium stabilized stainless steel with welded or flanged and gasketed joints as the case may be. Non-acid duct work is constructed of galvanized sheet steel painted inside and out with several coats of corrosion resistant paint.



SAFETY AND ECONOMY result from connecting oxygen and acetylene cylinders to manifolds and piping these gases to points of use in construction of new power plant. Cylinders are delivered to manifold platform by truck

Manifolding Oxygen, Acetylene Cylinders Cuts Piping Costs

IN THE CONSTRUCTION of a large steam-electric generating plant, huge quantities of oxygen and acetylene are necessary for welding, cutting, heating and bending, and stress relieving, as well as for the installation of the thousands of feet of piping.

The handling of oxygen and acetylene cylinders on jobs of this type has long been recognized as a major problem. Normally, the cylinders, distributed from a central point on the job, are hoisted to the various floors and placed in racks near each operation. In addition to the tremendous amount of cylinder handling and the space taken up by these cylinder racks, extreme safety precautions must be taken to prevent cylinders from falling on workmen below.

To eliminate such problems in the construction of the new Moss Landing power plant of the Pacific Gas and Electric Co., near Monterey, Calif., and to reduce the cost entailed by individual cylinder handling, an idea was borrowed from the shipyards and other industrial installations. As before, the central cylinder handling depot was set up near the boiler house. However, instead of locating cylinders at vantage points all over the place, the cylinders were connected to manifolds supplying temporary oxygen and acetylene pipe lines. These pipe lines were run up the side of the boiler house and branches taken off for each working level. Outlets for connecting the welding and cutting torches and other oxyacetylene equipment were provided at vantage points. This was done during the initial phases of erection work and piped oxygen and acetylene were available on the job almost from the start.

Equipment Can Be Dismantled

Originally, only one oxygen and one acetylene main were installed. However, this proved so successful that additional mains were installed to facilitate operations and speed the work. Also, piping was run to the shops.

The entire cost of the equipment and installation of the oxygen and acetylene piping was about one-fourth the estimated cost of cylinder handling by the former method. However, since this equipment is a temporary installation, it can be dismantled and transported to another job. As a result, the saving on future operations will be greater since the only expense will be installation cost.

By using this improved procedure employing temporary pipe lines, cost was reduced by elimination of excessive cylinder handling and larger working areas were provided because cylinders were kept out of the way.

Safety conditions also were improved since it was not necessary to transport and store cylinders on the structure.

Pipe Welding • Radiant Heating • Air Conditioning

feature discussions at HPACCNA convention

The Heating, Piping and Air Conditioning Contractors National Association assembled in convention at Washington last month to discuss trade problems and practices and to hear reports from its committees and officers of the work done during the year. Informal sessions on pipe welding, radiant heating (including snow melting) and air conditioning featured the gathering, are reported here

The Heating, Piping and Air Conditioning Contractors National Association — many of whose members are somewhat harassed by the details of government limitation orders on construction and materials, and paper work involved in government projects — met appropriately in Washington last month for its 62nd annual convention under the chairmanship of Wray M. Scott, Omaha, the retiring national president. The engineering and installation practices for heating, piping and air conditioning industrial buildings for defense production, as well as procedures and trade promotion for normal civilian building requirements, were discussed at well-attended sessions and in committee reports, the requirements of Navy work were described, and the construction program in which the Army is involved was reviewed.

Attendance at the meeting approached the 900 mark, including members, guests and the ladies.

Snow melting installations are no longer selected on the "novelty basis" (that is, for publicity purposes) but for straight economic reasons, according to Peter B. Gordon, chairman of the association's committee on radiant panel heating at a round-table session which was one of the features of the convention.

Snow Melting a "Novelty" No More

Snow melting systems for sidewalks; industrial, public and private roadways; highway bridges; loading ramps and docks; bridge overpasses and underpasses; and many similar applications have proved to pay out in dollars and cents, and consequently many other such installations are foreseen for the future.

The radiant heating committee of the association has developed during the last year a series of 98 lantern slides selected from a group of over 700 photographs and has prepared accompanying text material for each slide. Sets of these slides and the captions will be available to members of the HPACCNA for use in describing the applications, installation methods and advantages of radiant heating and snow melting to groups of architects, general contractors and others. The slides were shown and explained at the radiant heating session.

In some of the pictures illustrating snow melting, it was indicated that no trouble should be encountered from "channelling" — that is, melting of the snow directly over the pipes but not between them — if reasonable center distances for the pipe coils (say 9, 12 or 15 in. centers) and reasonable depths of bury (4 in. or so) are employed. According to Mr. Gordon, however, channeling could be expected with 24 in. center distances.

Radiant Heating "Curiosity Items"

One group of the slides illustrated what Mr. Gordon termed "curiosity items". The first showed an installation of wall heating coils for prison cell blocks. By heating the concrete walls of these cells the walls are kept from being cold and damp, which would be the case otherwise and which would be uncomfortable and unhealthful for closely confined occupants.

Another of the illustrations which was a curiosity and which Mr. Gordon said was a puzzle to him was a swimming pool, the bottom slab of which had heating coils installed in it. Mr. Gordon said he thought there would be other ways of heating water for a swimming pool more economically. (In this connection an article in the August 1947 Heating, Piping & Air Conditioning described a somewhat similar installation for heating the contents of a large tank used in an industrial process.)

Another of the curiosity slides showed the floor coil installation for heating a private railroad car for the President of Mexico. This installation was briefly described in the December 1948 Heating, Piping & Air Conditioning.

Yet another of the slides indicated an application which could perhaps be termed "outdoor heating". While perhaps too many conventional heating installations, due to insufficient or poor insulation, do heat the outdoors, there are some applications

where it is deliberately the objective. The particular slide showed an outdoor patio with heating coils in the floor slab, and other applications mentioned included such establishments as sidewalk cafes.

The fifth "curiosity slide" showed a two-pipe heating coil installed along the stanchions in a cow barn. It was explained in the discussion later that some preliminary studies at the agricultural school at Cornell had indicated that if the floor slab in a cow barn were heated, the possibilities of diseases of the udder were reduced.

In a lively discussion on radiant heating following the presentation of the series of 98 slides, one member of the group warned against a too hot condition in a radiant heated building where several of the returns were grouped together at one point. Care should be taken, he stressed, to group such returns in a space where excessive heat would not be objectionable.

Hydrostatic Tests of Radiant Heating

Another participant discussed hydrostatic tests of radiant heating installations, where it is sometimes difficult to follow specifications requiring the holding of a test pressure over, say, a 4 hr period with no change in the pressure. In many locations the sun effect will tend to build up the test pressure — for example, if the hydrostatic pressure is put on early in the morning and the coils are warmed up by the sun during the day.

A question on the possibility of electrolysis with copper tubing attached to steel wire lath in a ceiling heating installation was brought up. It was pointed out that this would depend on galvanic action, which requires the presence of moisture, and that after the initial drying out of the plaster there would be no moisture present. It was stated that no evidence of any such corrosion had been found on a great variety of installations.

Another question discussed was the disposal of water resulting from the melting of snow on snow melting jobs. Practically all of the melted snow vaporizes, and it was felt that no special provisions for run-off of the melted snow were ordinarily necessary.

Going back to ceiling heating installations, it was asked what percentage of the tube or pipe surface should be covered with plaster. It was agreed that with ½ to ¾ in. IPS, the area of plaster contact should be from 30 to 40 percent, and with ½ in. OD copper tubing, the contact area should perhaps be 40 to 50 percent.

A. V. Hutchinson, executive secretary of the American Society of Heating and Ventilating Engineers, attended the session and was asked to explain the ASHVE research program on panel heating, the budget for which is somewhat over $45,000 for the current year. Mr. Hutchinson said that the support of the HPACCNA, its local associations and its individual members in aid of this research project was much appreciated by the society.

Mr. Gordon, who is chairman of the ASHVE's technical advisory committee on panel heating and cooling, explained the nature and the scope of the society's program. He pointed out that the work also involved the society's technical advisory committee on sensations of comfort, and that radiation was to be introduced as a measurable factor in the feeling of comfort as indicated by the society's effective temperature chart. The present effective temperature chart was developed some years ago and does not include the effect of radiation — a factor which, of course, becomes important with radiant panel heating and also with panel cooling, which is beginning to be practically applied (see ASHVE Journal Section in the May 1951 HPAC, for example).

Automatic Venting of Radiant Heating

Because of the interest in this session, the discussion period was then continued and the matter of automatic venting of radiant heating installations was discussed. It was pointed out that due to the small orifice sizes, automatic vents cannot be used satisfactorily for the *initial* venting of a radiant heating installation, but that after the initial venting the automatic vents are entirely O.K. One speaker said that at least the equivalent of a ¼ in. petcock should be used for initial venting.

The effect of floor coverings on floor panel heating systems was the subject of another question, and in reply Mr. Gordon said that on a single zone installation, if one of the rooms has a wall-to-wall carpet, that room will lag behind other rooms without floor coverings. He pointed out that the effect of such a carpet would be less with an insulated, light floor slab than it would be with a heavy, uninsulated slab.

Packaged vs. Central Air Conditioning

When to use packaged air conditioning equipment and when a central station installation is indicated was the principal subject of discussion at the air conditioning and refrigeration panel discussion sponsored by the association's committee on air conditioning, and presided over by William S. Bodinus, the committee chairman, G. W. Spohn, Jr. and D. A. Forberg. An important advantage of the self-contained packaged equipment is that it can be moved by the owner when his lease expires and also that it can often be installed with less cutting up of the building, it was said.

In opposition to this viewpoint, it was brought out in the discussion that there is often a direct tax advantage to an owner who makes a capital improvement to a building by installing central air conditioning, and that the possibility of such a tax advantage should be carefully studied before a cost comparison is made between self-contained versus centralized air conditioning.

Regarding the cutting up of an existing building to install air conditioning, it was pointed out that installation of a system comprising a central chilled water plant serving air handling units on the various floors of a building can be made with no more cutting up of the structure than is required by self-contained units. An advantage of an installation of this kind is often found where water from a cooling tower or evaporative condenser is required for condensing, which is often a problem with self-contained units. This condensing problem is very much simplified with a centralized water chilling plant.

Each Job Needs Careful Analysis

The whole problem seemed to boil down to the fact that almost any installation needs careful analysis and study of the particular factors involved, and that the contractor should

do everything possible to promote the idea of a qualified consulting engineer designing and specifying the type of installation. There was some difference of opinion as to whether packaged units could sometimes be used where a central installation just couldn't be made, several members of the audience feeling that with enough ingenuity on the part of the designing engineer, some form of central installation could generally be adapted to advantage.

The importance to the owner of having deep enough cooling coils to permit the maximum capacity for a given horsepower was stressed, and one participant in the discussion pointed out that one of the cheapest investments an owner can make is having coils of the proper depth, as otherwise a penalty is paid over the life of the installation in higher operating costs. However, single row coils have proved surprisingly good in many cases, and again the proper choice depends on the correct engineering analysis of the installation.

Air Conditioning Potential "Terrific"

It is highly important — in fact, it is essential — that the "old line" heating contractor be organized and equipped to handle air conditioning. Mr. Bodinus stated that he felt the air conditioning business was going to "wag" the heating business one of these days and that any heating contractor who was not set up to do air conditioning work was "missing the boat" very badly. We have only "scratched the surface" in applying air conditioning to many types of buildings, he said.

A representative of a large heating contractor in a big city said that there were "terrific potentialities" in the air conditioning field. He said that perhaps one-third to one-half of his company's business was air conditioning — the rest being heating and piping work — and that on a dollar basis, of the total of $2 million business done last year by this firm, about $900,000 was air conditioning.

At the conclusion of the session, the possibility of "investigating and doing something" about disparities in ratings of air conditioning coils and evaporative condensers was discussed, and hope was expressed that a program could be initiated by the association on rating this and other air conditioning equipment similar to the net load recommendations for heating boilers which the association has issued for many years.

Certified Pipe Welding Organization

At the round-table session on welding, at which Richard S. Tobin, chairman of the association's committee on welding, presided, practically all of the discussion centered around the method of forming local chapters of the National Certified Pipe Welding Bureau. It was pointed out that in the process of organizing such chapters and qualifying the first few welding operators, every contractor would learn "about as much as he needed to know" regarding welding techniques. It was stated that the contractor himself does not need to know the theory of welding to supervise and inspect welders and to select the proper welding equipment and such welding materials as electrodes, rods, etc.

It was mentioned incidentally that the term "pipefitter welder" is the latest technical and approved definition for a pipefitter who is qualified to do welding.

It was brought up by one member of the audience that a bill introduced in a state legislature would provide that on all public works, standards would be set up for testing and qualifying a welding operator under the state apprenticeship committee. This would conflict with the objectives of the National Certified Pipe Welding Bureau. Under the ASME code, the contractor is responsible for qualifying welders and certifying welds, but this bill does not mention the ASME code in any way.

It was strongly indicated in the discussion that the employer — that is, the contractor — is responsible for the work and that this must be so, as the contractor is the one who pays for fixing a defective weld, for example. Also, it is well recognized that good, sound welding depends not only on the welding operator's skill but on the equipment, the material and the working conditions furnished the operator by the contractor.

The discussion reflected some difference of opinion as to whether the United Association (the pipefitters) was in favor of or opposed to this state bill.

In returning to the discussion of the formation of local chapters of the National Certified Pipe Welding Bureau, it was pointed out by Professor Robert S. Green, technical advisor to the association's committee on welding, that the ideal was to qualify in any locality enough pipefitter welders to do the work of that particular area.

Qualifying the Pipefitter Welders

Preliminary training of operators before they are tested reduces tremendously the cost of qualifying them, it was stated. It was estimated that the cost of testing an operator amounts to about $35 in Boston, and that the cost of training an operator before testing might amount to $20 a man. Because of the much greater proportion of operators who qualify when tested if they have had some preliminary training, it was recommended that a regular training program be undertaken for economy reasons.

E. P. Everhard, of Chicago, chairman of the bureau's technical committee, spoke against preliminary training before testing and said that in his area if a man says he is a welder operator, he is given the benefit of the doubt and tested. Experience there has been that three out of four passed the test, although there is a brief preliminary "testing" before a man is given the formal test. However, it was pointed out that in Chicago the level of welding skill is quite high as compared with some other areas because of the length of time that pipe welding has been done there and because of the excellent apprenticeship training program for pipefitters, which stresses welding.

Human Relations an Important Angle

John H. Zink explained that in addition to the technical and practical details of testing and qualifying welder operators, there is a very important human relations angle to be considered. He has, for the last four years, made his shop available one evening a week to the union in connection with its welding program. He has also made available the scrap material and supplies needed for training and testing welders. The shop is completely equipped with testing equipment, and the tests are made without charge.

The welder operator makes a number of welds using scrap pipe and the familiarity thus acquired assists him in keeping from being nervous when the formal test is made. Over the past four years, some 500 welders have been trained and tested in this way, and only about four have not followed through and become qualified, Mr. Zink said.

Should Backing Rings Be Used?

The subject of testing and qualifying welder operators was then dropped and the matter of how extensively backing rings are used in pipe welding was discussed. H. E. McGregor said that such rings make it easier for the welder, and when you do anything to make it easier for the welder, you get better welds. Mr. Zink said it was the practice of his shop to use backing rings as standard on all piping from ½ in. diameter up, that backing rings were important in preventing icicles on the inside of piping, and that with them you get a faster weld. Backing rings are, he said, a good investment as they are quite inexpensive. Mr. Tobin mentioned that it was also the practice of his shop to use backing rings throughout.

Professor Green raised the technical point that it is possible to make a stronger weld without a ring than with one, as the use of a ring puts two severe notches in each joint and these notches tend to concentrate the stress at these points. He admitted, however, that the possible bad effects of not using a ring may outweigh this technical objection.

"One friend is worth all the DO numbers in the United States," said one member of the audience parenthetically in a brief discussion on difficulties being experienced in getting ample supplies of welding rod.

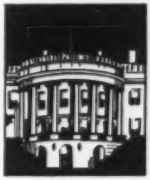
Pipe Welding Manual Published

Many years of extensive work of the association's editorial and research committees culminated at the convention with the publication of the second edition of the Standard Manual on Pipe Welding, copies of which are available from the Heating, Piping and Air Conditioning Contractors National Association, 1250 Avenue of the Americas, New York City, for $7.50. Copies of this over-500 page book were on sale at the convention. The book covers the entire field of pipe welding as it is known today, said Mr. Zink, chairman of the two committees that prepared it, and contains many useful tables and formulas which the contractor needs from day to day in his pipe welding operations.

Mr. Zink said that the editorial committee had now finished its work and should be discharged; however, the research committee should be continued as it is engaged in the important work of determining heat treatment of alloy steels, especially the stainless steels, and on other projects. Mr. Zink pointed out that the committee had taken an active part in the revision of the Code for Pressure Piping, as well as reconciling the welding requirements of this code with the ASME Boiler Construction Code.

Pipe Welding Bureau Issues Procedures

In his report as chairman of the board of trustees of the National Certified Pipe Welding Bureau, John S. Jung announced that the bureau now consists of 20 local chapters with 255 members and that three chapters had been formed during the year — in New Orleans, Kentucky and Omaha.



Since the last report of the bureau to the convention, the bureau has published for the use of its members five fully tested standard procedure specifications, as follows:

No. 1—Metallic Arc Welding of Wrought Iron and Steel Pipe, Fittings and Flanges.

No. 2—Oxy-Acetylene Welding of Wrought Iron and Steel Pipe, Fittings and Flanges.

No. 3—Metallic-Arc Welding of Carbon Molybdenum Steel Pipe, Fittings and Flanges.

No. 4—Metallic-Arc Welding of Chrome Molybdenum Alloy Steel Pipe, Fittings and Flanges.

No. 5—Metallic-Arc Welding of 2¼% Chrome, 1% Molybdenum Alloy Steel Pipe, Fittings and Flanges.

Also, the bureau has published a pamphlet entitled Pipefitter Welder's Review of Metallic Arc Welding for Qualification under ASME Code Rules, by Robert S. Green, the bureau's consultant. He is working on another pamphlet on oxy-acetylene welding which will be published as soon as it is ready.

The purpose of these pamphlets is to assist journeymen to pass the prescribed tests by pointing out to them various items which contribute to good welds.

The bureau is also investigating the welding of stainless steel and aluminum. The board of trustees has appropriated $5000 to carry on that work during the current year. This work is going forward under the supervision of E. P. Everhard, chairman of the technical committee, and Professor Green.

The board of trustees believes that the bureau has contributed greatly to high standards of welding in the piping field. Its increased usefulness depends on more local chapters and greater membership, said Mr. Jung in conclusion.

H. E. McGregor Elected President

At the concluding session of the convention on Friday morning, H. E. McGregor, Cambridge, Mass., was unanimously elected national president for the ensuing year. William Murray, Jr., New York City, was named vice president, and R. W. Lawinger, Chicago, was elected national treasurer.

The newly elected three-year members of the board of directors of the HPACCNA are W. E. Beggs, Seattle; J. DeWitt Morrow, Houston; K. A. Stephenson, Atlanta; and Gustav Nottberg, Kansas City.

It was announced that newly elected officers of the junior association are Donald L. McConachie, Detroit, president; William V. Hoier, Chicago, vice president; and Frank E. Dorsey, Washington, secretary-treasurer.

It was also announced that the 63rd annual convention of the association will be held during the first week of June 1952 in Boston.

As the contractors adjourned, the city of Washington was being taken over by some 25,000 members of school safety patrols from all over the country who were to parade the following day under the leadership of Hopalong Cassidy and were busy sightseeing and buying out the candy and souvenir counters in preparation for the event.

"Boiler Room in the Sky"

Many Advantages of 20th Floor Location for Packaged Steam Generators at Tulsa Building

By Arnold M. Gaynor
Gaynor and Albright, Consulting Engineers

The boiler room is behind the exterior aluminum louvers, at about the area covered by the "1st of Tulsa" sign. Advantages of this location are summarized in the text

THE LOWEST LEVEL of a building is usually the location for its boiler room, and during the early preliminary stages of design it was assumed that the First National building, Tulsa, would be so arranged. This $6 million bank and office building has 21 floors above street level, plus a basement floor used as public banking space and a sub-basement for mechanical equipment and storage. However, when test borings were analyzed, it became evident that it would be very costly to lower the footings and depress the proposed boiler room floor to the extent required for piping clearances. Under these circumstances, serious study was given to the possibility of some alternate boiler room location.

Two Principal Load Centers

The building is entirely air conditioned, and is heated by a combination of air supplied by the air conditioning equipment and a system of peripheral convector radiation. Outside air is brought into the building at the 20th floor, where it passes through a series of coils, is heated or dehumidified as required, and is distributed to fan rooms throughout the building. The peripheral convectors are supplied with hot water circulated through a one pipe system. This method eliminates the necessity for any valves or traps at the convectors, simplifies the zone control arrangement, and of course reduced the initial piping costs and subsequent maintenance. Hot water is obtained from six steam-fed converters in the sub-basement.

There are, therefore, two principal load centers supplied with steam — one, the outside air preheater coils on the 20th floor and the other the hot water converters in the sub-basement. The division of load between these two is as follows (in Btu per hr), neglecting piping, pick-up and convection losses:

20th fl. preheater coils	3,096,200
Sub-basement converters	5,197,774
Total	8,293,971

With 37 percent of the total steam load at one point on the 20th floor, design attention was focused on the interesting possibility of reversing the usual order of things by locating the boiler room on that level. The fact that the available fuel is natural gas made such a location seem feasible and worthy of study.

It was found that by a rearrangement of other mechanical equipment, it would be possible to make sufficient space available for a boiler room adjacent to the outside air supply plenum chamber, which places the boilers immediately next to 37 percent of their load. The 20th floor boiler room is behind the exterior aluminum louvers, at about the area covered by the "1st of Tulsa" sign in the photo of the building reproduced herewith.

The boiler equipment consists of 200 hp packaged steam generators. For maximum operating economy, domestic hot water is obtained from a separate 10 hp boiler in the sub-basement.

Advantages of Boilers On 20th Floor

A study of the 20th floor boiler room location disclosed the following:

1) A stack running the entire height of the building is thus eliminated, which is valuable in two ways — the cost of the stack is saved, and

the stack space within the building is available for other utilities.

2) The heat of the boiler room is eliminated from the ceiling of the sub-basement. This heat gain would have been a major factor in the zone control of the air conditioning for the basement area above, which is an important banking space.

3) Valuable bank storage space is acquired in the sub-basement.

4) The necessity for an extensive boiler room supply and exhaust ventilating system is eliminated. As installed on the 20th floor, the boiler room has grille openings directly to the outside.

5) It required an 8 in. gas line up to the 20th floor, with a gas pressure regulator at each boiler. However, it is probable that the pressure regulators would have been required at any location in order to assure maximum burner efficiency.

6) It required a 10 in. steam supply line from the 20th floor to the sub-basement converters. However, if the boiler room had been in the sub-basement, an 8 in. steam supply line would have had to be run to the 20th floor preheater coils. The net effect of the 20th floor boiler room location is, therefore, to increase this vertical supply line by one size.

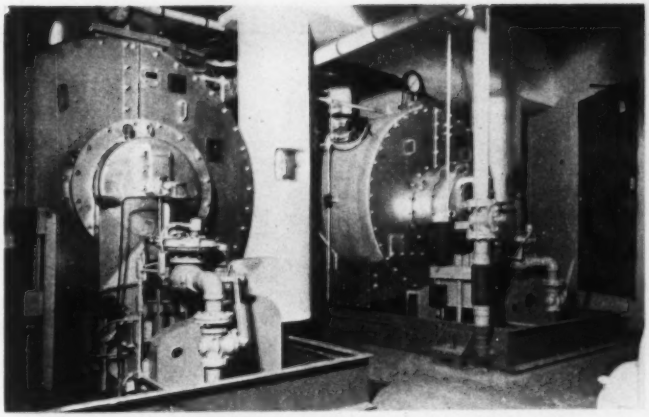
7) No additional operating personnel is required by locating the boiler room on the 20th floor, since there is sufficient other major mechanical equipment in that area to make it necessary for operating personnel to be located both there and in the sub-basement.

8) The only additional structural steel required is the horizontal members at the 20th floor, arranged so as to distribute the weight of the boilers among the vertical columns, which were already amply sized to take this additional load. The dead weight of each boiler, with normal water capacity, is approximately 37,000 lb.

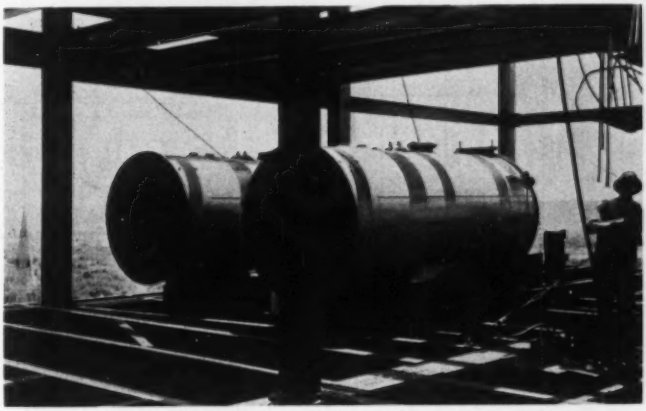
Translated into dollars, the above factors showed a considerable saving in favor of the 20th floor location, when considered with the cost of excavations and foundations for the original sub-basement location.

Boiler Delivery Carefully Scheduled

It was very important to schedule carefully the delivery of the boilers so that they could be rigged up to the 20th floor while the steel erectors' rigging was still available. This was done, and the boilers were suspended from the steel at the 21st floor level while the boiler room floor was constructed. The boilers were mounted on vibration eliminating units, which have adequately prevented the transmission of vibration into the building structure.



THE TWO 200 HP PACKAGED steam generators on the 20th floor level are immediately next to 37 percent of the building's steam load. The boilers are mounted on vibration eliminating units

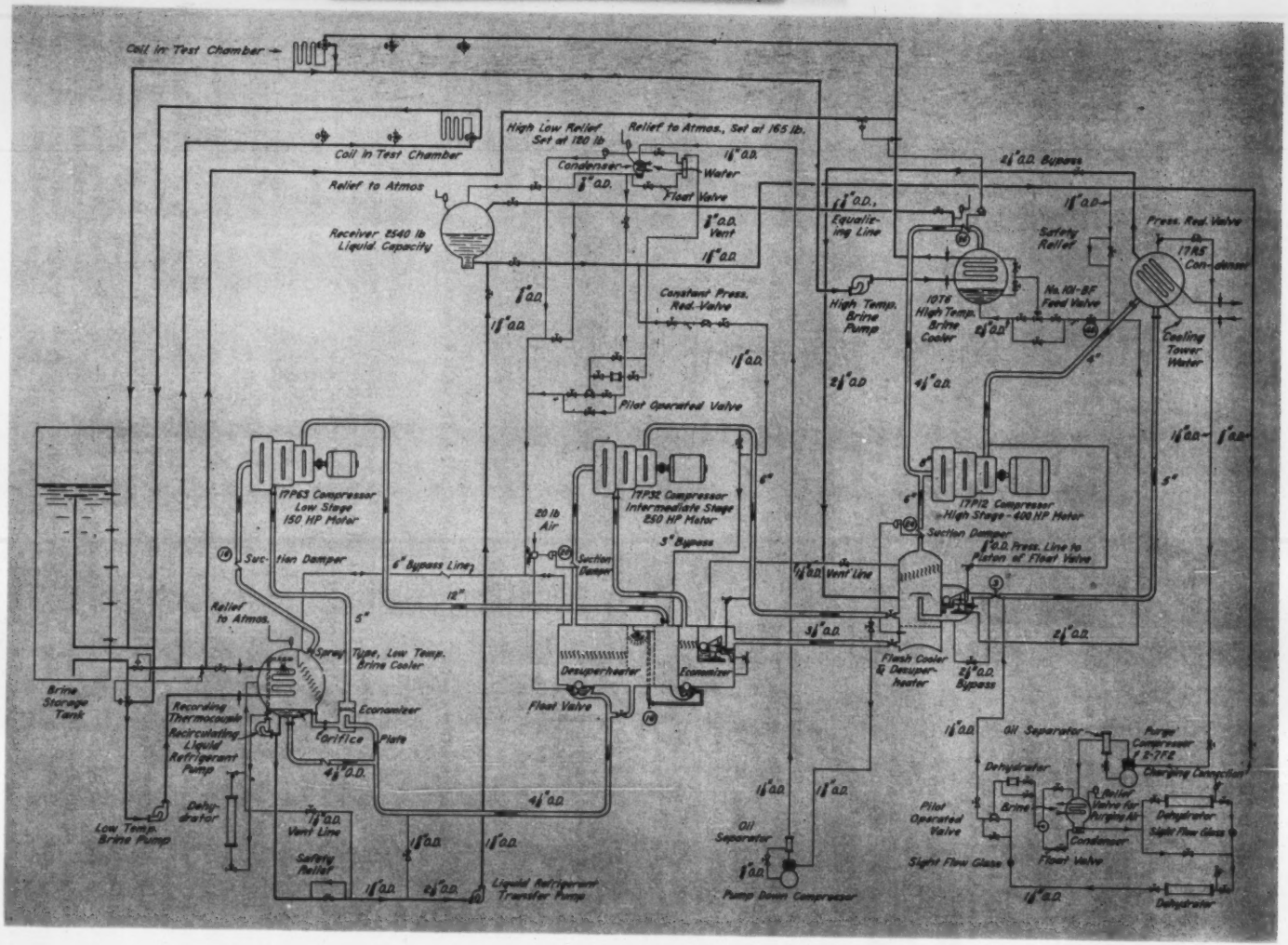


BOILER DELIVERY WAS SCHEDULED carefully so that they could be rigged up to the 20th floor while the steel erectors' rigging was still available

The arrangement for boiler blowdown worked out very satisfactorily. It would, of course, be undesirable to discharge high temperature boiler water into the building waste lines. The solution was to install a 150 gal blowdown tank in the accessible 5 ft hung ceiling space immediately below the boilers. Boiler water is blown down into this tank, mixed with cold water and then discharged into an adjacent 4 in. waste stack.

Finally, mention should be made of one design feature in this case that required special study. Because of the long water columns involved in the boiler circuits, it was necessary to insure against the possibility of violent priming or siphonage. Connections and valving are so arranged that this hazard has been practically eliminated.

After nearly a year of operation, this "boiler room in the sky" has proved to be an efficient and practical design. While it would of course be absurd to conclude from this instance that more boiler rooms should be located at the tops of buildings, it does emphasize that the designing engineer must always remain alert to analyze each problem on its individual merits.


Coil in Test Chamber
Coil in Test Chamber
High Low Relief Set at 120 lb
Relief to Atmos., Set at 165 lb.
Condenser
Water
Float Valve
Relief to Atmos
Receiver 2540 lb Liquid Capacity
Constant Press. Red. Valve
Pilot Operated Valve
17P63 Compressor Low Stage 150 HP Motor
17P32 Compressor Intermediate Stage 250 HP Motor
17P12 Compressor High Stage - 400 HP Motor
20 lb Air
Suction Damper
6" Bypass Line
3" Bypass
Relief to Atmos.
Spray Type, Low Temp. Brine Cooler
Brine Storage Tank
Recording Thermocouple Recirculating Liquid Refrigerant Pump
Economizer
Orifice Plate
Desuperheater
Economizer
Float Valve
Flash Cooler & Desuperheater
2½" O.D. Bypass
Vent Line
Safety Relief
Liquid Refrigerant Transfer Pump
Oil Separator
Pump Down Compressor
Dehydrator
Brine
Pilot Operated Valve
Sight Flow Glass
Condenser
Float Valve
Purge Compressor 17-7F2
Charging Connection
Equalizing Line
Safety Relief
Press. Red. Valve
17R5 Condenser
No. 101-BF Feed Valve
10T6 High Temp. Brine Cooler
High Temp. Brine Pump
Cooling Tower Water
Low Temp. Brine Pump

Low Temperature Piping and Air Conditioning Essential

. . . . in testing equipment for the Air Force

Of compelling importance to the Air Force is the prevention of equipment and material failures under every imaginable condition. Basic tools for the testing operations at the Wright-Patterson Air Force Base are air conditioning and the low temperature refrigeration system serving the conditioning installations. These facilities are a striking example of the essential nature of air conditioning and refrigeration in national defense production and modern industrial practice

THE CHIEF PROBLEMS facing aeronautical engineers of this country are those involved in developing planes to fly higher, faster, farther, more economically and with greater safety. The prevention of equipment failure as a result of the widely varied climatic and environmental conditions imposed by global operations is a fundamental part of these problems.

During World War II, the Air Force was plagued both on the ground and in the air by equipment failure due to material deterioration. High temperatures and humidities of the South Pacific brought fungus and electronic breakdown; sand and dry desert heat of North Africa represented constant threats to operational reliability of equipment; salt and fog over island bases and shore areas meant corroded parts and equipment malfunction. Added problems were those of temperature and vibration conditions at both high and low altitude flight.

The prevention of equipment and material failure is a problem of compelling importance to the Air Force, and to that end an intensive program of pre-service testing is under way in the Equipment Laboratory at Wright-Patterson Air Force Base, Dayton, Ohio. With the new Environmental Test Facilities, any type of weather found anywhere around the globe can be produced and altitudes up to 150,000 ft can be simulated. Temperatures from −125 to 250 F, relative humidities from 2 to 100 percent, sunshine, rain, snow, sand and dust storms, and salt fog can be created at will. The basic tool—in fact, the very heart of this vitally important testing—is air conditioning, the installation involving an extensive low temperature refrigeration system.

Brine Coils

Chill Test Chambers

Major purpose of the 800 hp refrigeration system is to chill two independent brine circuits. The brine is circulated to the various test chambers to cool them by means of heat transfer coils within the chambers. For example, the low temperature chamber, which is approximately 7 ft square and 8-½ ft high, may be used to subject material and equipment to temperatures ranging from −112 F to 80 F. Durations of test runs are unlimited and temperature variations may be automatically cycled to simulate varying flight and ground conditions.

Brine at −125 F is circulated to the heat transfer coils which have three fins per inch. In order to cycle temperatures, heat must be applied quickly and low mass electric heaters are used, together with a ventilation rate of 12 air changes per min. The observation window utilizes eight panes of glass, forming seven air spaces, to minimize heat transfer.

The low temperature-altitude chamber is similar except that the temperature range is from −112 F to 80 F and air pressure may be reduced to simulate altitudes up to 55,000 ft. The various conditions may be automatically cycled and the durations of the test runs may be up to seven days, depending on requirements. In addition to an ambient temperature system, this chamber has a ram air system, with controlled dew point, used to simulate air cooling of engine parts. This requires a 140 hp motor with a variable speed of 1400 to 9000 rpm.

In the all-weather high-low temperature and humidity chamber, temperatures of −112 F to 160 F may be automatically controlled, and at temperatures above 40 F the relative humidity may be varied from atmospheric to 95 percent. Depending on the nature of the test, durations of runs may be up to 30 days.

The combination high-low temperature and altitude cabinet is a smaller unit of the reach-in type. Conditions may be cycled to simulate the diving of a plane and the temperature range is from −112 F to 250 F. The high temperature is necessary to simulate high speed flights and this is accomplished by utilizing radiant heat from low mass electric heaters. Because of the rarified at-

Opposite

SCHEMATIC CYCLE DIAGRAM for "Freon 12" and brine low temperature refrigeration installation, operation of which is explained in the text

SYSTEM IS CONTROLLED from this well-equipped board. A diagram of the cycle similar to that reproduced with this article is mounted with these instruments and controls

mosphere, it is necessary to use a fan driven by a 20 hp motor operating at 1750 rpm to move a sufficient amount of air over the coils.

Sun's Rays Duplicated

Duplication of the spectrum from the sun's rays on June 21 at the equator is accomplished in the sun and rain chamber. The overhead lighting system is designed to provide 2800 to 7600 angstrom units of ultraviolet light and 3800 to 30,000 angstrom units of infra-red. An overhead sprinkler system is used to simulate 1 to 4 in. per hr of rainfall.

The effects of high humidities on equipment and material are tested in several different chambers. One of these is a cabinet having a temperature range from 40 to 185 F. It is suitable for tests involving special conditions, such as 160 F and 95 to 100 percent relative humidity. Another humidity chamber, suitable for conducting tests on larger items of equipment, permits cycling of conditions on a predetermined program. This is accomplished by electronic controls and the range of permissible relative humidities is from 30 to 100 percent. The temperature range is from 40 to 185 F.

In humidifying the various chambers, steam is admitted and the water used for generating steam is first demineralized (to 10 ppm or better) and then stored in a 3000 gal glass lined tank. The pH value and the amount of dissolved oxygen are also controlled.

Most of the damage to equipment and material due to high humidities occurs during the first five days of a test. However, most humidity tests are run over a 15 day period.

Arid conditions are reproduced in a chamber operated at temperatures from 40 to 220 F. In addition to low mass electric heating elements, brine coils are used, and these not only dehumidify the air but provide close temperature control—since bypass dampers are used. Temperature and humidity conditions are automatically programmed, indicated and controlled.

There are many other test facilities in use to simulate desert sand storms, salt fog, optimum conditions for fungus growth, etc. Over 2000 items of equipment are tested each year. Current emphasis in the testing program is placed on meeting the added temperature stress on materials traveling at very high speed and at high altitude.

Two Brine Circuits Necessary

The chief function of the refrigeration system is to chill two independent circuits of brine for the test chambers. One of the circuits is known as "low temperature brine" and has a minimum temperature of −125 F. It is used in those chambers requiring very low temperatures. The other is known as "high temperature brine", at a minimum of 30 F, and is used for the balance of the test chambers. In both cases, the brine is liquid methylene chloride to which a red oil dye has been added to make any leaks apparent.

The three-element refrigeration system is directly staged and "Freon-12" is the refrigerant. Centrifugal compression is used in each stage. The low stage compressor is a three-wheel unit with a single stage economizer. The intermediate stage compressor is also a three-wheel centrifugal machine with a single stage economizer. The high stage unit, again a three-wheel centrifugal compressor, does not have an economizer. Low temperature brine is cooled in a flash type spray deck shell and tube evaporator connected to the suction of the low stage. High temperature brine is cooled in a flooded type shell and tube evaporator (10T6, at upper right of diagram) connected to the suction of the high stage. All compressors are driven by variable speed slip ring induction motors using manual selection.

Referring to the flow diagram, liquid refrigerant drains by gravity from the bottom of the condenser (17R5) through valve No. 3 to a "bubble" located on the side of a vertical flash cooler and desuperheater. This "bubble" houses the first of two special high pressure type float valves and provides a reservoir of liquid refrigerant (at condenser pressure), part of which is supplied to the high temperature brine cooler (10T6). The connection for supplying this cooler is taken from the bottom of the "bubble" and ahead of the float valve. This liquid is delivered through valve No. 46 to a feed valve (No. 101-BF) actuated

by a float to the refrigerant level in the cooler.

Flash Cooler and Desuperheater Used

The remaining portion of the condensed liquid passes through the float valve and is expanded into the vertical flash cooler and desuperheater, where it flashes to high stage suction pressure and cools itself to a temperature corresponding to that pressure. In addition, a portion of the flashed liquid is vaporized to desuperheat the superheated vapor delivered by the intermediate stage compressor. The desuperheated gas, joined by flash gas and generated gas due to desuperheating, passes through an eliminator to separate and return entrained liquid, and thence through an automatic butterfly valve (No. 24) to the high stage compressor. Refrigerant vaporized in the high temperature brine cooler (10T6) passes through automatic butterfly valve No. 25 and is also directed to the high stage compressor.

The cooled liquid falls to the bottom of the vertical flash cooler and flows by gravity to a second special high pressure float valve located within the horizontal flash cooler and desuperheater, at the drive end of the intermediate stage unit. Here the liquid is flashed again, to a pressure corresponding to the first wheel discharge pressure of the intermediate stage compressor. This is the second stage of the economizer effect. After this, the remaining liquid flows through a standard type float valve and is further flashed to the intermediate stage compressor suction pressure. Enough liquid is diverted (ahead of the float valve) through valve No. 10 to desuperheat the low stage discharge gas. This is the third stage of the economizer effect. The action accomplished within the horizontal flash cooler and desuperheater is similar to that already described, though the arrangement and design are different. The flash gas and generated gas due to desuperheating enter the intermediate stage suction through an automatic suction damper (No. 20).

Finally, the balance of the liquid is discharged through a standard type float valve (in the "bubble" at the bottom of the horizontal desuperheater and at the compressor end). The resultant liquid and flash gas are delivered to the low stage economizer which comprises the fourth stage of the economizer effect. In this vertical tank, the flash gas is separated and delivered interwheel to the low stage compressor. In the last step of liquid feeding, the remaining liquid is discharged to the low temperature brine cooler through an orifice (in lieu of another standard float valve). This orifice is sized to maintain a liquid seal at design load and may pass an inconsequential weight of gas, in addition to liquid, at lighter loads.

In the low temperature cooler, liquid refrigerant is recirculated by means of a vertically mounted liquor pump to a perforated spray deck located immediately above a tube bundle through which the brine is directed. In cooling, the brine gives up heat which vaporizes the refrigerant. The resultant saturated gas is drawn through an eliminator, by means of a controllable damper (No. 18), and into the suction of the low stage compressor.

The low stage compressor compresses and heats the refrigerant vapor through three wheels (the economizer gas through two wheels) and delivers both to the horizontal desuperheater. Here the gas is cooled and desuperheated, passed again through an eliminator, and through a damper to the intermediate stage compressor.

Likewise, the intermediate stage compressor compresses this vapor through three wheels, and the economizer gas through two wheels and discharges both to the vertical desuperheater. Cooling and desuperheating is repeated and the resultant total gas passes on to the suction of the high stage compressor.

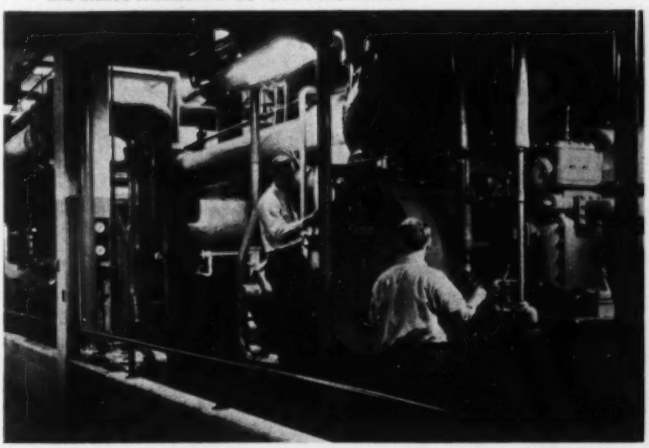
At the high stage compressor suction, the side load gas from the high temperature brine cooler (10T6) joins the stream and both are compressed to a pressure necessary to produce condensation in the condenser, consistent with condenser water temperature available. Here the refrigerant is liquefied, completing the cycle.

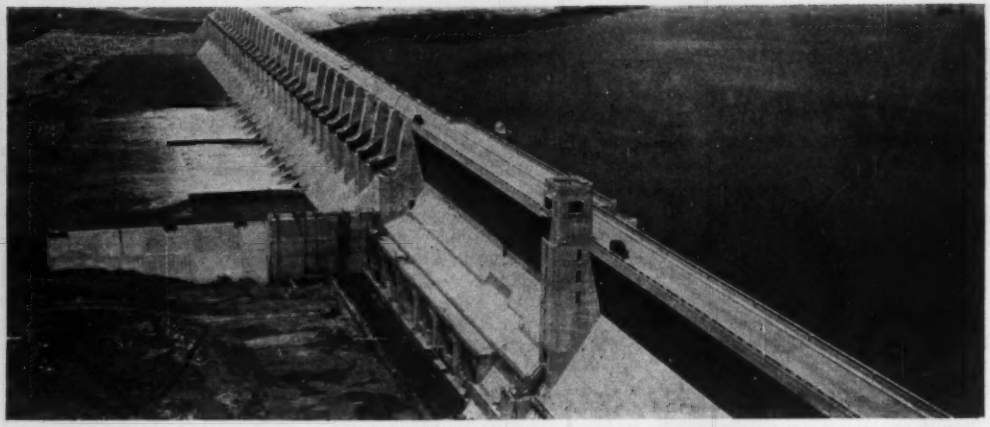
Brine Stored in 30,000 Gal Tank

The low temperature brine is piped to a 30,000 gal storage tank made of monel metal which is covered with 12 in. of insulation. Controls are so arranged that the storage tank can carry the entire load for the testing chambers, can assist in meeting the load, or can be recharged while the refrigeration plant is being used for only some of the test chamber load demand. The temperature of the brine in the tank is never allowed to rise above -80 F. With this storage arrangement, the refrigeration plant can be shut down for long periods and be turned on for special low temperature requirements, according to the testing schedule or to recharge the tank.

[Photos courtesy of the USAF Materiel Command and Carrier Corp.]

THE 800 HP REFRIGERATION system's chief function is to cool low temperature brine which is circulated in two independent circuits to maintain desired conditions in the various test cabinets





EXAMPLE GIVEN IN TEXT assumes a hydroelectric power house with a heating load of 583,000 Btu per hr and a cooling load of 250,000 Btu, shows how a heat pump system might work out

Application of the Heat Pump To Hydroelectric Power House

The heat pump or reverse refrigeration cycle is interesting because of the wide variety of its applications. For example, small heat pumps are used for heating domestic service water (and give a dividend in keeping the basement dry). It has also been suggested recently that steam power generating stations would be good heat sources and sinks for handling the heating and cooling requirements of nearby housing developments. In this article, Fred T. Downing, mechanical engineer, discusses the heat pump for meeting the heating and cooling needs in hydroelectric power houses

IT HAS RECENTLY been found practical to heat and cool hydroelectric power houses and the administration buildings in connection with them with electrically driven heat pumps. The reservoir water from Austin dam in Texas, for example, is used in a heat pump application that furnishes year-around air conditioning to the Lower Colorado River Authority's three story office building at the dam site. Several power houses under design and construction are using heat pump systems for conditioning air.

It was thought expedient to study the possibility of using the reservoir water at various dams for heat pump applications. A hypothetical power house in the vicinity of the Possum Kingdom dam, Texas, was used as a basis for the study.

The heat pump, as popularly termed, is of course simply a refrigeration unit with an electric motor, compressor, condenser and evaporator operated to make use of heat instead of cold. The heat pump system includes the heat pump, fan and motor, pump and pump motor and other auxiliaries. Such a unit operated in a refrigerator pumps heat from the refrigerator into the surrounding air. This cools the refrigerator inside and slightly warms the outside air.

Operated as a heat pump, the unit takes heat out of water, the earth or outside air and supplies it to the space to be heated.

The same heat pump system may be used to cool the space to be conditioned during the summer, by interchanging the functions of the condenser and the evaporator.

The heat pump operates as shown in the accompanying sketch, with well-known refrigerants such as ammonia, sulphur dioxide or "Freon". This diagram indicates simple heating only; however, valve and piping changes can afford cooling. The performance ratio of heat energy delivered by a heat pump to energy consumed is called the "Coefficient of Performance". In terms of heat, it is COP = (electric energy supplied + energy drawn from heat source) ÷ (electric energy supplied). This ratio is always greater than one, hence it should not be called efficiency.

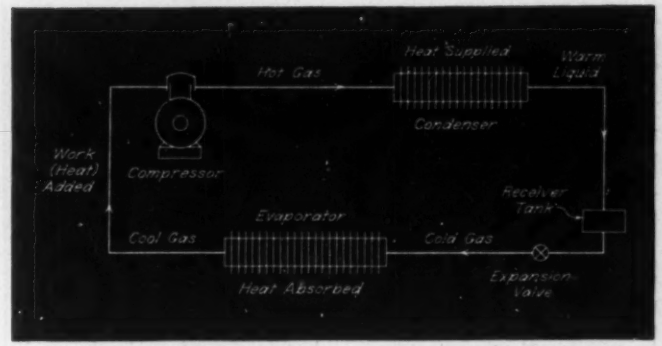
Theoretical coefficients of performance at any instant are calculated on the basis of absolute temperatures.

The actual coefficient of performance over a period of time, which reflects the inefficiency of heat transfer equipment, pumps and compressors is calculated on an energy basis as COP = (heat supplied from electricity + heat extracted from water) ÷ (heat supplied from electricity).

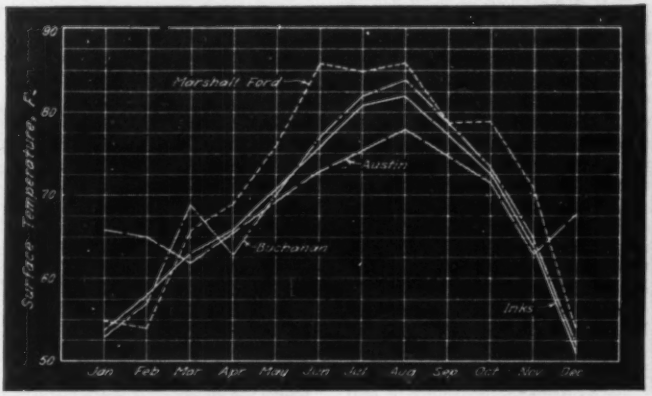
The value of the COP depends partly upon the temperature level of the heat at the condenser; the higher that temperature, the poorer the performance. It also depends upon the temperature level of the heat source which supplies heat to the evaporator. The lower that temperature, the poorer the performance. The COP of the heat pump will be increased by decreasing the temperature difference between the temperature of the space being heated and that of the source of heat. The temperature of the heat source should be fairly uniform over the year whether the source is a ground coil, outside air or water. Wide variations in the temperature of the heat source change the COP materially.

Reservoir Water As Heat Source

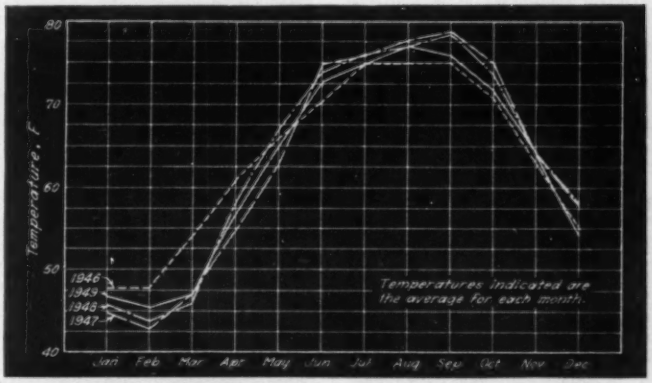
A heat source, such as well or reservoir water of constant supply, is a favorable and suitable source of heat for a reverse-cycle or heat pump



THIS SIMPLIFIED SKETCH shows how a heat pump operates. The heat source may be the earth, outside air or water. Use of dam reservoir water as the source is discussed here



LAKE SURFACE TEMPERATURES for year 1945 for various dams on Lower Colorado River Authority project



TEMPERATURE OF LAKE SURFACE for Denison dam, Texas, for various years, the temperatures indicated being the averages for each month

system. Accompanying figures show surface water temperature variations over the year at various reservoirs on the Colorado and Red rivers in Texas. This variation in water temperature over the year is not too desirable for heat pump applications which require a constant supply of water at one temperature for the best COP.

The surface water temperatures are not generally those that exist in the reservoir 50 to 100 ft below the surface. Temperatures at these depths are usually more constant. In some reservoirs the water temperatures at these depths are 15 to 18 deg lower than at the surface. The temperature difference is more marked in the summer than in the winter months. This temperature gradient would be more favorable to a heat pump design and the accompanying curves would be flatter. The heat pump can be adapted to this changing temperature by proper design range with a thermal storage arrangement if needed. The reservoir water temperature ranges indicated in the accompanying figures will not deter the use of a heat pump design for heating and cooling at the particular reservoir if desired. Considerable variation in the COP of the heat pump would be expected over the year, but the average would be favorable. It is believed that where hydroelectric power stations have reservoir waters within the range of temperatures shown, a heat pump could well be used to heat and cool the station and compete favorably with direct electric heat and separate cooling equipment. The COP for cooling would obviously be below the COP for heating because of the high temperature of the reservoir waters during the summer cooling period. This is especially true when the COP for direct electric heating is 1 and that of a heat pump, with a water source about 55 F, is 3.5 to 4.

Example of Application To Power House

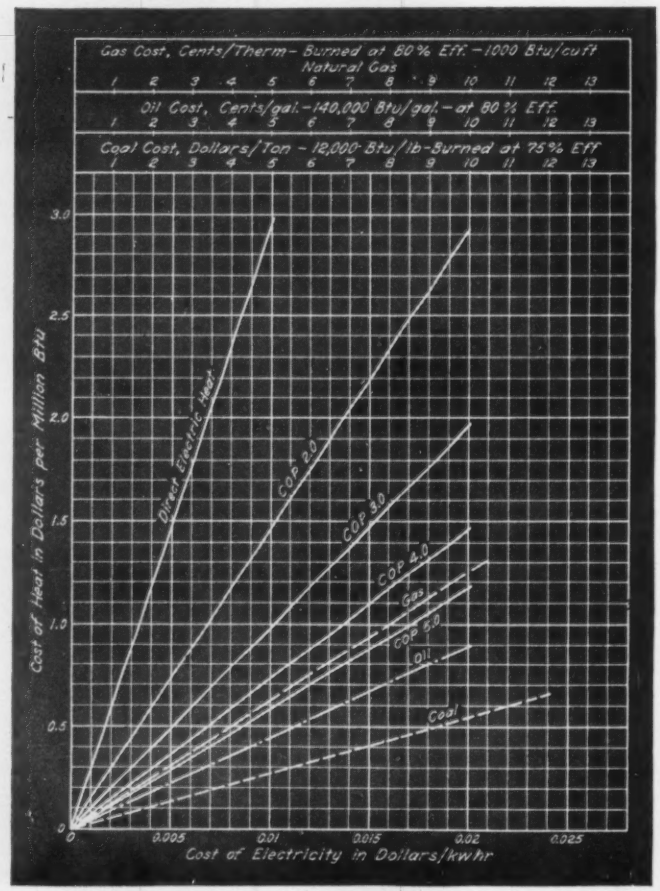
Inasmuch as the reservoir temperatures at the various dams on the Colorado river are within ranges that could be utilized for the heat source of a heat pump application, it is believed a reservoir in the vicinity of these dams would have similar reservoir temperatures. On this supposition the main heat load requirements for the generator and turbine rooms of a hypothetical power house were used for the investigation of a heat pump application within the expected temperature range of the reservoir. The heat load Btu equivalent for the power house rooms was assumed at 583,000. The actual cooling load for the power house would probably be 250,000 Btu per hr., which is about 50 percent of the heating load. The COP for cooling is one unit below the heating COP in each particular.

The significance of the COP of a heat pump can be easily shown. If 1 kwhr of energy is supplied to a 100 percent efficient electrically driven heat pump, which in turn delivers 6 kwhr of energy for heating, the heat pump is said to have a theoretical COP of 6. The COP of direct heating with electric heaters is 1. Accompanying curves indicate not only the comparative heating costs with various fuels but also the cost of heating with a heat pump. The COP of the heat pump is variable. The cost of heating the turbine and generator rooms of the hypothetical power house example was determined with these assumptions:

a) Heat rate of 583,000 Btu per hr, equivalent to 171 kwhr.
b) Degree days, 2355 on 70 F basis.
c) Cost of power at "SPA rates". Cost of energy 0.75c per kwhr. Cost based on demand charge, $1.15 per kw.

The calculated comparative heating costs are as follows:

COMPARATIVE HEATING COSTS with various fuels, direct electric heat and the heat pump at various coefficents of performance. (Adapted from similar curves by Estel B. Penrod, University of Kentucky, in paper on Development of the Heat Pump)


Gas Cost, Cents/Therm – Burned at 80% Eff. – 1000 Btu/cuft Natural Gas
1 2 3 4 5 6 7 8 9 10 11 12 13
Oil Cost, Cents/gal. – 140,000 Btu/gal. – at 80% Eff.
1 2 3 4 5 6 7 8 9 10 11 12 13
Coal Cost, Dollars/Ton – 12,000 Btu/lb – Burned at 75% Eff
1 2 3 4 5 6 7 8 9 10 11 12 13
Cost of Heat in Dollars per Million Btu
3.0
2.5
2.0
1.5
1.0
0.5
0
Direct Electric Heat
COP 2.0
COP 3.0
COP 4.0
Gas
COP 5.0
Oil
Coal
0.005
0.01
0.015
0.02
0.025
Cost of Electricity in Dollars/kwhr

a) Direct Electric Heating:
   1) *Energy Basis:* 475,000,000 Btu per season divided by 3413 = 139,000 kwhr. With electric energy at 0.75c per kwhr the cost is $1040
   2) *Demand Charge Basis:* Based on 171 kw demand per month and five months operation at $1.15 kw per month .. $983
b) Heat Pump Heating with Reservoir Temperature of 50 F:
   1) *Energy Basis:* 30.6 kw energy to compressor at 475,000,000 Btu per season based on 171 kw direct heating and COP = 5.55. Cost per season = $1040/5.55 ..... $187
   2) *Demand Charge Basis.* Based on 171 kw *direct heating.* Cost per season = $983/5.55 ..... $178

The above COP for the hypothetical heat pump is perhaps too high, but experience has dictated that the average COP for many domestic and commercial heat pump installations is approximately 3.30. It is believed that a heat pump installation for the assumed power house would cost approximately $25,000. This expenditure would, of course, provide for both the heating and cooling demands of the power house.

This heat pump study is quite condensed. No attempt has been made to cover all the factors that must be considered before adapting the heat pump cycle to a particular water source, nor to present current commercial design practice. It should be noted that to insure high performance of the heat pump the equipment must be of a high order of efficiency.

It is acknowledged that some of the formulas presented herein and the curves of comparative heating costs are the same as or similar to such information contained in the following papers, to which the author referred: The Residential Heat Pump in New England, by Charles H. Coogan, Jr., University of Connecticut; Development of the Heat Pump, by Estel B. Penrod, University of Kentucky; Heat Pump System Using Water Storage, by Philip Sporn and E. R. Ambrose; Thermodynamic Criteria for Heat Pump Performance, by John F. Sandfort, Ames, Iowa.

HOLD AIR POLLUTION SESSION AT WISCONSIN

IN VIEW OF THE current interest in control of air pollution in major cities of the country, a seminar was held April 11 at the University of Wisconsin, Madison, for the benefit of those municipal and industrial engineers concerned with the problem.

After a welcome by M. O. Withey, dean of the college of engineering, J. E. Brown, air pollution control engineer of the department of smoke regulation, County of Milwaukee, discussed sources of pollution, effects of climate and topography, and the health and economic aspects of air pollution. Mr. Brown emphasized that perhaps the largest number of contaminants comes from sources other than power plants, incinerators, locomotives, etc., and that air pollution problems vary greatly with the location of the particular municipality and the meteorological conditions normally existing in the locality.

THIS GROUP ATTENDED a one-day "Institute on Air Pollution Control" held at the University of Wisconsin recently in cooperation with the League of Wisconsin Municipalities

Many millions of dollars have been spent for the control of dust, smoke and gases from power plants, and with proper combustion control there is no real reason for the discharge of large volumes of smoke and fly ash from power plants. On the other hand, it has been found that the discharge of contaminants from industrial processes is far more difficult to control and as yet there has not been worked out the necessary standards for the control of many industrial dusts, smokes and fumes.

Fred R. Rehm, deputy air pollution control engineer of the department of smoke regulation, County of Milwaukee, discussed in very complete detail the methods of detection and determination of air contaminants. Mr. Rehm brought with him various types of sampling equipment and described their operation.

Following Mr. Rehm's address, the group heard from Joseph Harrington, of the Southern Coal Co., Chicago, who discussed the advantages to be gained in the use of overfiring to eliminate the discharge of smoke from boiler stacks, in addition to the efficiency in boiler operation.

Dr. A. D. Singh, president of the A. D. Singh Co., Chicago, presented a discussion of the local problems arising from air pollution laws as well as a discussion of some of the laws now in existence. Problems involved in the drafting of ordinances were discussed with the suggestion that industry in general be vitally concerned lest ordinances of an impractical and unworkable nature be invoked. Dr. Singh brought out the point particularly that some determination of the type and the amount of contamination to be prohibited must be made.

The last speaker of the day was Anthony Sidlow, air pollution control engineer of the city of Green Bay, Wis. He emphasized that the position of air pollution control engineer is in most instances a full time job and cannot efficiently be handled by a municipal official who has other assigned duties.

The one-day meeting ended with the issuance of certificates of attendance by H. E. Pulver, professor of engineering and director of the engineering institutes of the University of Wisconsin.

ONLY NEW FIRMS NEED MAKE DO-97 REPORTS

BUSINESS FIRMS, government agencies or public or private institutions which were in operation in 1950 need *not* make reports of quarterly quotas to NPA on materials used for maintenance, repair and operating supplies (MRO), the National Production Authority, U. S. Department of Commerce, has emphasized.

NPA made the explanation because some organizations, apparently misunderstanding section 4 of regulation 4, have gone to the unnecessary expense and bother of continuing to make reports. This is the regulation that permits the use of defense order (DO-97) ratings for procurement of MRO supplies.

Only new companies which were not in operation last year, or were only in partial operation, need make these MRO reports, NPA said.

How Can I Figure Supports for a Horizontal Tank?

. . . . . asks a reader, and Theodore E. Bridge suggests a solution here. The problem is analogous to support of large thin wall pipe

How to support a vessel 10 ft, 10 in. in diameter by 50 ft, 0 in. was the problem posed by a reader of HPAC recently. The vessel is fabricated from A-285 steel plate, ¼ in. thick, with dished heads. The tank is to be used for ammonia absorption and will be filled with water. The operating pressure will be 25 psi. The tank will be horizontal and will be supported by concrete saddles. The problem is how far apart to place the saddles and how many saddles to use without putting undue stress on the shell plate. Mr. Bridge was asked to suggest a solution.

SOLVING THIS PROBLEM on the support of a large diameter thin walled tank is attempted with some misgivings. The calculation of conditions which produce buckling in thin plates has puzzled some of the best engineering minds in the country. The solution offered here is not necessarily the most economical one possible, as the problem has been simplified by making a rather sweeping assumption. It should, however, be a satisfactory one from the standpoint of safety. Correspondence is invited on this subject from those interested in such problems.

As far as buckling is concerned, stress is not a factor. The worst condition comes with the tank full of water but with no pressure in the tank. Pressure in the tank would hold the shell taut and prevent buckling.

The problem is to provide a number of supports for the tank so that the bending stress in the shell may be reduced to the point where buckling will not occur between the supports. The supports will be wrapped around the bottom half of the shell to restrain the shell from buckling at the supports.

It is believed that whenever a tank buckles due to its own weight, it will tend to flatten; and that holding the sides in at a support will prevent buckling at that point.

Only a low order of accuracy will be carried in this calculation because of the rough assumption which must be made later in calculating the conditions which will produce buckling in the shell. The bending moment is given in almost any handbook on mechanical engineering for a continuous beam with three, four, five, six, seven or even more supports equally spaced. For all practical purposes, as far as this calculation is concerned, the following equation will give the maximum bending moment for a continuous beam with any number of supports, when M = bending moment, ft-lb; W = load on the beam, lb per ft; and L = length of beam between supports, ft:

$$M = W L^2 / 10 \quad \ldots\ldots\ldots\ldots\ldots\ldots [1]$$

Let S = bending stress, lb per sq ft; D = mean diameter of shell, ft; $C = D/2$ = radius of shell, ft; I = moment of inertia of the cross section of the tank, ft⁴; and t = the thickness of the shell, ft.

$$I = \pi D^3 t / 8$$

$$S = M C / I$$

$$= (W L^2 D 8) / (10 \times 2 \times \pi D^2 t)$$

$$= (W L^2) / 7.85 D^2 t \quad \ldots\ldots\ldots [2]$$

The bending stress calculated from Equation 2 will probably be very small. But for thin wall tanks such as the one described in the question, even a low longitudinal compressive stress might produce buckling. The object of this calculation is to find a value for L which will not permit the wall of the tank to buckle.

Necessary To Make Bold Assumption

It is now necessary to make a very bold assumption. It will be assumed that the portion of the shell that is in longitudinal compression is flat so that no stiffness is obtained from the curvature of the plate. In most cases, this assumption will be very far on the safe side.

This assumption is considered justifiable in the interest of simplicity for those cases in which the following conditions are observed:

a) Consider only a portion of the entire cross section of the cylinder such that the length of the portion is about equal to, say, 50 times the wall thickness of the section.

b) If the least moment of inertia of this portion about an axis through its center of gravity is Is, and if it is substantially equal to If, the least moment of inertia of a flat plate having the same dimensions (width = 50 times the thickness), this assumption is considered to be not too far off.

c) For other conditions, this assumption might be much too conservative.

d) A correction might be made for other conditions by multiplying L^4

Mr. Bridge acquired a wide experience in the design of power and process piping during 15 years with E. I. du Pont de Nemours & Co., and has also had experience in the field of very high pressures. At the time he prepared this article, he was a mechanical engineer with the University of Chicago in connection with a project under construction for the Argonne National Laboratory. He is now associated with United Engineers & Constructors, Inc. He has written a number of articles which have been published in HPAC, including an extensive series on how to space pipe supports. His most recent HPAC articles have been on the subject of piping flexibility.

in Equation 7 by the ratio (Is/If) calculated for the above mentioned section. At best, the above assumption is believed to be very conservative. Certainly, it is an arbitrary one.

To continue with the development of the theory, imagine that two longitudinal slots are cut through the shell (a unit distance apart) at the point where the maximum compressive stress S is generated. Analyze this length of the shell as if it were a column in compression. P is the axial load on the imaginary column described above, lb. A factor of safety of 2 will be applied such that:

$$P = 2\ S\ t \quad \ldots\ldots\ldots\ldots\ldots\ldots [3]$$

Substitute Equation 2 in Equation 3:

$$P = 2\ W\ L^2\ t\ /\ 7.85\ D^2\ t$$
$$= W\ L^2\ /\ 3.93\ D^2 \quad \ldots\ldots\ldots\ldots [4]$$

The critical length of a column may be determined from the Euler formula, assuming the ends of the column to be fixed.

The assumption of fixed supports is justified for two reasons. First, only the top section of the tank tends to buckle under compression, and under the weight of the water, it always tends to buckle downward. Second, only the middle portion of the column carries full load; it would be much too conservative to assume freely supported ends. The Euler formula is:

$$L^2 = 4\ \pi^2\ E\ Ic\ /\ P \quad \ldots\ldots\ldots\ldots\ldots [5]$$

L is the length of the column and is equal to the distance between supports, as before. E is Young's modulus of elasticity, lb per sq ft and for steel is 144 × 29,000,000 or 4,180,000,000. Ic is the moment of inertia of the imaginary column of unit width, ft.[4]

$$Ic = t^3\ /\ 12 \quad \ldots\ldots\ldots\ldots\ldots\ldots [6]$$

Substitute Equations 6 and 4 in Equation 5:

$$L^2 = 4\ \pi^2\ E\ t^3\ 3.93\ D^2\ /\ 12\ W\ L^2$$
$$L^4 = 1.31\ \pi^2\ E\ t^3\ D^2\ /\ W \quad \ldots\ldots\ldots [7]$$

In our problem, $t = 0.25/12 = 0.0208$; $t^3 = 9/1{,}000{,}000$; $D = 10.83$; $D^2 = 118$. ¼ in. steel plate weighs 10 lb per sq ft. Therefore, Ws = weight of shell = $10\ \pi\ D$ = 340 lb per ft. Also, Wc = weight of contents = $62.5\ \pi\ D^2/4$ = 5760 lb per ft. $W = Ws + Wc$ = 6100 lb per ft. Solving Equation 7, L^4 = 1.31 × 9.9 × 4,180,000,000 × 9 × 118 / 1,000,000 × 6100 = 9400 and L = 9.85.

Supports Should Be 10 Ft Apart

On the basis of this study, the maximum distance between supports should be approximately 10 ft (L = 9.85). It is therefore indicated that six supports are required. The saddles should extend around the bottom half of the tank to prevent buckling of the shell.

It is probable that the assumption made in which the shell was assumed to be flat, for the purpose of calculating buckling, is far on the safe side.

If only five supports were provided, and if a bearing plate 2 ft wide were provided at each support, the calculated condition of L = 10 ft would still be maintained. L would be the distance between the edges of the bearing plates, making the supports 12 ft on centers. Some overhang up to ($L/4$) beyond the end supports is desirable. This might provide a cheaper and probably a more satisfactory solution to the problem, as the concentrated load at the support would be distributed over a wider area on the shell.

The author knows of no test results with which this problem might be checked, but he has used a method similar to this in designing stiffeners for a large kiln.

Answer Checked with Thin Wall Pipe Data

A book entitled Handbook of Welded Steel Pipe, published in 1942 by the California Corrugated Culvert Co., Los Angeles, contains much information on supporting large diameter thin wall pipe. The problem here is analogous but goes beyond the range of the tables in that book. Table No. 61 in that book indicates that a 6 ft diameter pipe with ¼ in. wall thickness may be supported on saddles 72 ft apart provided the pipe is reinforced at the support with ½ in. thick plate extending 18 in. each side of the center of the support. Two 8 × 6 × ⅝ in. stiffening angles are formed around the pipe on either side of the support, and welded to the pipe to prevent buckling at the support.

In our problem, the diameter of the tank is 80 percent larger than the pipe in the above example while the wall thickness is the same. It is obvious that our tank is much more vulnerable to buckling and our calculation indicates that supports are needed much closer together.

COMMITTEE INTERPRETS B-9 REFRIGERATION CODE

THE AMERICAN STANDARDS Association sectional committee that formulated the American Standard Safety Code for Mechanical Refrigeration, ASA B9.1-1950, has appointed an interpretations subcommittee, whose chairman is E. T. Benson, Frigidaire Div., General Motors Corp., 300 Taylor St., Dayton 1, Ohio, and whose secretary is M. C. Turpin, of the American Society of Refrigerating Engineers.

This subcommittee — which meets quarterly and corresponds "continuously" — is charged with the responsibility of interpretation of the intent of the code's provisions.

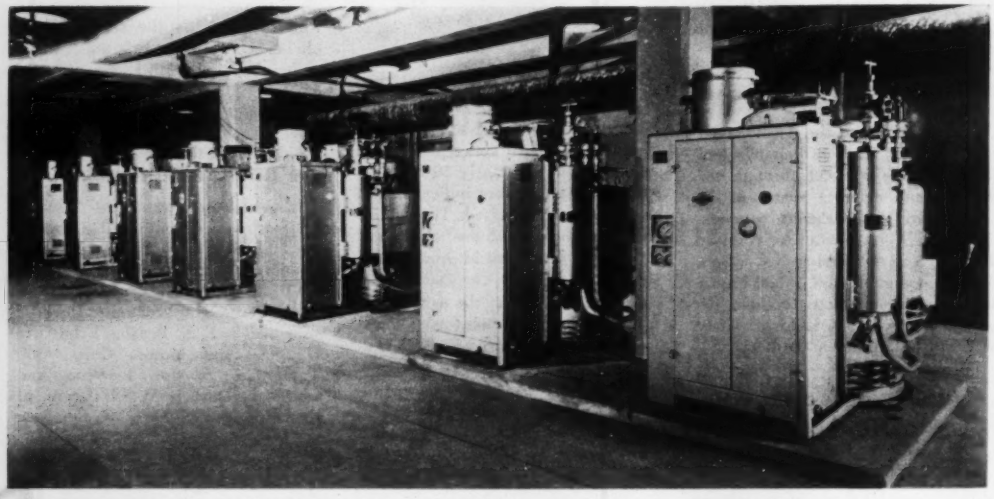
Inquiries regarding interpretations of the B-9 code should be addressed to M. C. Turpin, Secretary, Interpretations Subcommittee, ASA B-9 Safety Code, American Standards Association, 70 E. 45th St., New York 17, N.Y.

HOLDS AIR CONDITIONING SESSION FOR ARCHITECTS

IN AN ATTEMPT to give architects "a broader understanding" of air conditioning, the Cleveland Air Conditioning Corp. presented recently an evening devoted to a discussion of air conditioning principles, with information on cooling loads, air distribution, application methods, and "all of the other things that make our business sound complicated".

Talks were given on basic air conditioning and psychrometric definitions, cooling loads, the psychrometric chart, the refrigeration cycle, types of air conditioning installations, and operating costs.

Attendance was somewhat smaller than originally expected, which was believed to be partly due to the fact that the President was speaking that evening on the Korean situation, but the questions asked seemed to bear on all of the various talks and indicated to Leonard F. Auerbach, president of the Cleveland Air Conditioning Corp., that there was general interest in the entire subject and that "the affair was a success."



SEVEN STEAM GENERATORS supply the hot water and steam requirements of the new Union Pacific laundry at Ogden, Utah. The piping is in a trough under the floor plates. Combustion air intake and exhaust ducts had not been installed when picture was taken.

Seven Steam Generators Serve Railroad Laundry

J. E. LaRocque, Chief Steam Generator Engineer, Vapor Heating Corp., describes briefly the method of furnishing steam and hot water at the new Union Pacific laundry, Ogden, Utah

A REVOLUTIONARY METHOD of heating water for laundering purposes is being employed at the new Union Pacific Railroad laundry, Ogden, Utah, where a battery of seven packaged steam generators is used.

The method permits handling 3300 lb per hr of dry laundry. This means that 13,333 pieces of dirty laundry will be unloaded at the south end of the newly erected building and within an hour and a half it will come out the other end of the building, washed, dried, ironed, folded, counted and tied in bundles ready for delivery to the commissary across the street.

The new fast-heating steam generators employed at the laundry were designed originally for heating passenger cars on diesel powered trains. Each of the seven units installed in the laundry is capable of making over 4500 lb per hr of steam, a total of over 31,500 lb.

The speed in which they can be put into operation is illustrated by the fact that each machine can develop 250 lb of steam pressure in 2 min from cold water; about 100 lb steam pressure will be used in the laundry.

The generators are each fired with a hot atomized diesel fuel oil fire and are completely automatic in operation from one-third to full capacity. A specially designed steam pressure switch turns on the fire in one or more units when steam pres-

sure in the line is down, and shuts down when the line pressure is high. Each machine has an electric eye to turn the unit off if the fire does not light up properly.

Hot gases from the diesel oil fire heat the seamless steel tubing through which water is pumped. There is a total of 702 ft of steel tubing coiled up in each generator.

The steam generators at the U.P. laundry will be used not only to heat the water to 180 deg for laundering purposes, but to heat the building in the winter. Steam developed by the generators will also be used in the operation of the washers, ironers and pressers. In the basement of the building there will be two large heat exchanger tanks, each of 2000 gal capacity. The steam not used in presses will be condensed and re-generated.

The laundry equipment includes eight washers, three extractors, four flatwork ironers, three dryers, 12 tumblers, 42 press units, six folders, one stacker, three tying machines, two continuous belt conveyors and a mono-rail system.

The plant will take care of linen from all Union Pacific passenger trains, Sun Valley and hotels and restaurants of the system with the exception of the southern Utah parks property of the railroad.

A complete dry cleaning system in the plant will handle drapes and uniforms from all over the railroad.

W. C. Perkins is the chief engineer for the Union Pacific, and L. W. Ashton is the U.P. engineer on location.

GOOD COMBUSTION, PRODUCT RECOVERY PROFITABLE

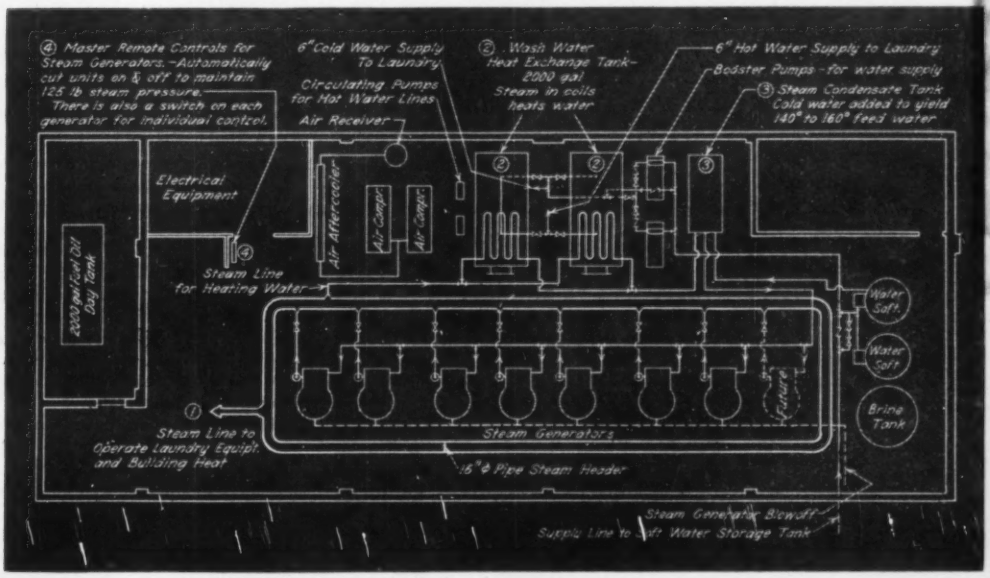
"TONS OF VITALLY needed strategic materials are lost forever — every hour of the day — through indifferent combustion efficiency or lack of product recovery," according to Ernest H. Peabody, founder and president of Peabody Engineering Corp. "Much of the material so lost could well represent not only a source of considerable net profit but would go far toward stretching our present supply of scarce materials needed for rearmament."

Whether such savings in fuel and raw materials are brought about by increased combustion efficiency, the use of effective product recovery equipment, or a combination of these is, he said, a matter that can be decided only by a complete analysis of the individual plant operating requirements.

To emphasize the potentialities for conservation of valuable materials, Mr. Peabody cited the case of a nationally known chemical manufacturer whose original intention in installing gas scrubber equipment was to eliminate an atmospheric pollution problem that his plant had created. The installation was not only successful in this but the equipment also recovered more than $100,000 worth of lime per year which was previously lost. Another example of this same salvage technique was applied in a paper mill with the result that more than 3500 tons of soda ash per year, approximately 90 percent of the total, was recovered for subsequent use and reprocessing.

In those cases of atmospheric pollution where dollar savings are not sufficient to justify capital expenditures by a private corporation for equipment to remove the products causing the pollution, Mr. Peabody added, it is to be hoped that the saving of critical materials, combined with a forward looking attitude on the part of public officials, will result in a cooperative effort by the municipality and the corporation which will enable the pollution problem to be controlled. There is no doubt, he concluded, that we can generate steam more efficiently, process more cleanly, and have cleaner, quieter cities throughout America, while at the same time saving materials essential to our rearmament program.

FLOOR PLAN OF SYSTEM shows piping connections and equipment location. Steam generators supply requirements of the laundering process as well as for building heating


④ Master Remote Controls for Steam Generators.—Automatically cut units on & off to maintain 125 lb steam pressure. There is also a switch on each generator for individual control.
6" Cold Water Supply To Laundry
Circulating Pumps for Hot Water Lines
Air Receiver
② Wash Water Heat Exchange Tank—2000 gal Steam in coils heats water
6" Hot Water Supply to Laundry
Booster Pumps—for water supply
③ Steam Condensate Tank Cold water added to yield 140° to 160° feed water
Electrical Equipment
Air Aftercooler
Air Compr.
Air Compr.
2000 gal Fuel Oil Day Tank
Steam Line for Heating Water
Water Soft.
Water Soft.
Brine Tank
Future
① Steam Line to Operate Laundry Equipt. and Building Heat
Steam Generators
16" ϕ Pipe Steam Header
Steam Generator Blowoff
Supply Line to Soft Water Storage Tank

Efficiency in Pipe Insulation Means Economy in Use

"It isn't the initial cost, it's the upkeep" that counts — with insulation and with almost anything else. In the case of pipe insulation, a few more dollars spent for the more efficient insulation originally may save many, many other dollars over its lifetime compared with an insulation of lower first cost and lower efficiency . . . . . That's the point brought out here, with an example to show how the figures stack up for an actual case

IT HAS BEEN roughly estimated that insulation represents about 1 percent of the total cost of a building. However, the degree of economy and efficiency provided by the insulation may vary widely, depending upon the type of installation for which that 1 percent is spent.

To be an economically satisfactory insulator, a material should not only pay for itself in the value of the heat saved early in the life of the plant or building in which it is used, but also annual operating cost of the insulation (i.e., the sum of annual heat loss cost plus annual amortized cost of insulation) should be as low as possible.

Field experience has indicated that a material of low conductivity generally makes a more economical insulation for piping and heating systems than one of higher conductivity, even though the initial cost of the former is greater. This is illustrated in the following actual example, which was taken from an estimate furnished by an insulating contractor.

A 4 in. line 6000 ft long carries 5 lb steam at about 220 F, and operates for 5000 hr per year. Heat production cost is estimated to be $0.60 per 1000 Btu. Insulation is to be amortized in 20 years. Insulation "I", of higher first cost, is of low conductivity as compared to insulation "II", which has a lower initial cost.

Comparative results on a yearly basis are:

	Insulation "I"	Insulation "II"
A) Amortized applied cost	$ 270	$ 195
B) Cost of heat loss with insulation	$1160	$1760
C) Value of heat saved	$6250	$5650

The combined insulation operating cost, $A + B$, is $1430 for "I" and $1955 for "II." Thus, insulation "I" costs $525 less per year to use than the lowest cost insulation. Another way to put it is that, due to the larger heat saving with "I", the initial cost difference between the two materials is quickly wiped out.

Good Performance An Essential

While the initial insulating ability of a material may be satisfactory, over a period of time it may deteriorate to the extent that maintenance costs are excessive. Furthermore, if deterioration makes re-insulation necessary, such work would be more expensive than the original insulation application, since installed equipment makes it difficult for mechanics to work, enclosures may have to be opened and the functioning of the plant or building and its occupants will be disturbed.

If heat causes shrinkage or warping of the material, gaps will occur at joints and allow heat to escape. Shrinkage also results in loosening of the bands which hold the insulation in place so that the material can fall away from the surface covered. The material should be resistant to damage or crushing from abuse incident to normal operations.

Where strict sanitary conditions must be obtained, as in hospitals or schools, the structure of the material must not provide a breeding place for roaches and other types of vermin that thrive in warm, dark spaces.

Unless it can withstand the effects of alternate wetting and drying, moisture and condensation will cause the insulation to disintegrate.

The physical characteristics of the material, therefore, should be such as to resist deterioration and maintain the insulating ability throughout the life of the installation, particularly if the applied cost is to be charged off over the equipment life.

INSULATING ABILITY of the insulation throughout the years is important, particularly if the cost is to be charged off over the life of the equipment covered

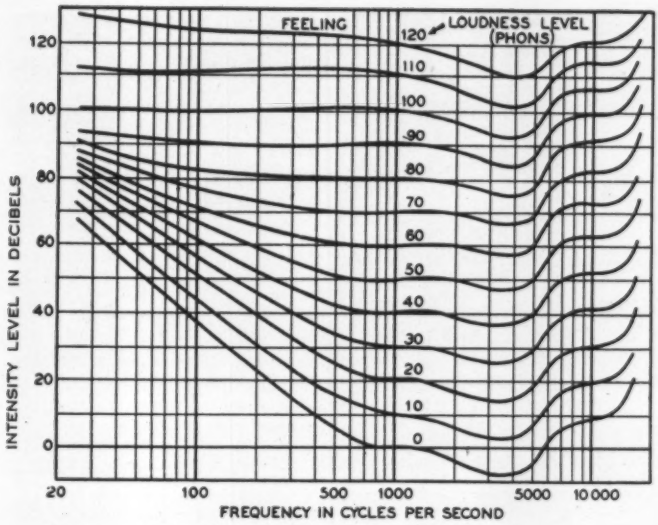


FIG. 1 — SENSITIVITY OF THE EAR varies with the frequency of sound according to these loudness level contours (from ASA Z24.2-1942, American Standard for Noise Measurement)

FAN NOISE LEVEL What Does It Mean?

R. A. Gerlitz, Chief Engineer, Propellair Div., Robbins & Myers, Inc., has noted a growing trend toward stating maximum noise levels for propeller fans in consulting engineers' and architects' specifications, without qualification as to noise quality or the noise rating test setup. He therefore prepared this article to explain the characteristics of the noise emanating from a propeller, to point out that two fans with equal noise levels are not necessarily equally acceptable to the ear, and to show that a noise rating is not a precise quantity which can be checked and confirmed in any test room

WE ARE SO accustomed to associating ratings of various kinds with the equipment we buy that there is a tendency to accept almost any form of "rating" as an accurate indication of performance under all conditions, without regard for the exact meaning of the rating.

Methods of rating noise levels have been studied for many years by eminent leaders in the field of acoustics for a wide range of subjects, but noise ratings still must be carefully analyzed to determine their true meanings. Present methods of rating noise levels are generally unsatisfactory, in the author's opinion.

Besides the pressure or intensity level, as commonly expressed in decibels, there are such factors as quality of the noise, frequency, ambient and reflected noise levels, and the personality of the listener, all of which affect the annoyance a noise produces. Thus, two fans which show equal noise ratings when tested under identical conditions may vary widely in the amount of annoyance detectable to the ear (in other words, "loudness" as commonly used), and the amount of variation will be different for different persons.

Sound levels usually are determined by sound level meters which give the sound intensity (power) level directly in decibels above the threshold of hearing. One decibel is the minimum change in sound intensity which the average ear can detect within the usual range of frequency and intensity. The sound intensity level represents the pickup by microphone and not by ear. The sensitivity of the ear varies with the frequency of the sound in accordance with the loudness level contours of Fig. 1. The American Standards Association defines the *loudness level* in phons as "numerically equal to the *intensity level* in decibels of the 1000 cycle per sec pure tone, which is judged by listeners to be equivalent in loudness."

For fans, the National Association of Fan Manufacturers' test code specifies that sound level readings be taken at seven positions about the fan at a distance of "one wheel diameter from edge of fan housing but not less than 5 ft, 0 in." The fan noise level is the average of the seven readings. Size or construction of the test room is not specified. Resultant noise ratings are not accurate quantities which can be verified from place to place, nor do they have a great deal of meaning when stated alone without further qualification. For example, there is a world of difference between the rat-a-tat-tat of a rivet hammer and the hum of a power plant, though their noise intensity levels may be equal.

Two Components of Fan Noise

The noise from a fan depends upon vortex noise resulting from the oscillatory acceleration of the air, and rotation noise caused by rotation of the steady pressure field surrounding each blade. The latter is the more annoying, being the component responsible for the char-

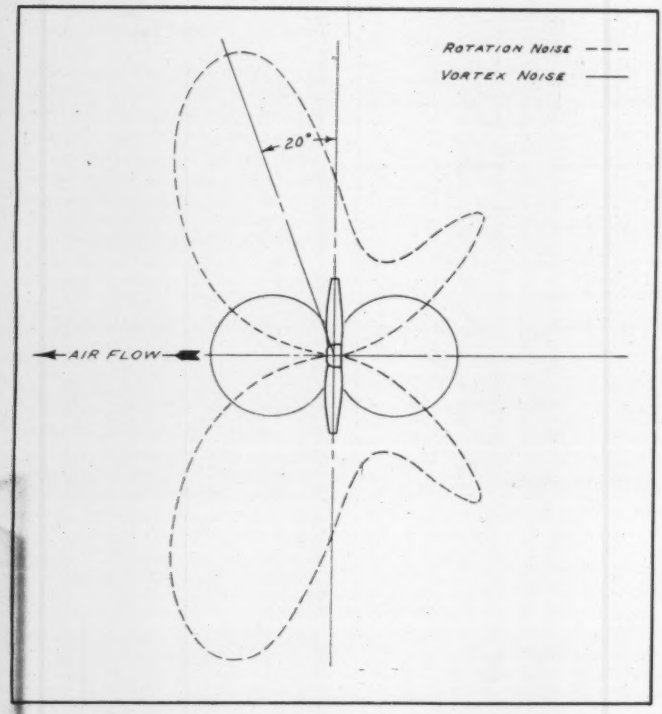


FIG. 2 — DISTRIBUTION OF PROPELLER NOISE (adapted from NACA Tech. Note 1195, On the Sound Field of a Rotating Propeller, and NACA Research Memo. L9J28a, Sound Measurements for Five Shrouded Propellers at Static Conditions)

acteristic throb of the airplane propeller; its frequency in pulses per second is equal to the revolutions per second multiplied by the number of blades.

Rotation noise predominates in high speed propeller fans with few blades, while vortex noise predominates in low speed multiblade propellers having equivalent power absorption capacity. It has been shown that the distribution of rotation noise emanating from a propeller is generally as indicated by the dashed curves of Fig. 2; the exact shape of the curves depends upon the propeller design and the condition of operation. The maximum intensity is always slightly downstream from the plane of rotation, usually 15 to 30 deg. Vortex noise distribution is as shown by the solid curves of Fig. 2, the maximum intensity lying on the axis of rotation.

TABLE 1 — CHARACTER of rotation noise

Tip speed, fpm	Character of noise
5,000	Soft flutter
10,000	Moderate throb
14,000	Sharp throb

TABLE 2 — EAR RESPONSE to rotation noise

Pulse frequency (Rpm/60) X no. of blades	Ear response
90	Distinct pulse
150	Pulse just noticeable
250	Smooth—no distinct pulse (May be a whine with high speed fans)

The disturbing pulsation of rotation noise is seldom recognized in fan specifications naming maximum acceptable noise levels, although it may actually be far more objectionable than the intensity of the noise. The human ear is much like the eye in its ability to distinguish separate impulses of sound. The average eye can, for example, distinguish the individual flashes of light from a 25 cycle neon lamp but fails to resolve the light from a 60 cycle lamp into separate flashes. With both ear and eye, it is the *distinguishable* impulses upon the sensory nerve ends which cause annoyance and fatigue. No investigations have been made, it seems, on the amount of annoyance due to pulsation of a noise. For propeller fans the character of rotation noise and the ear response to it is given approximately by the empirical relationships in Tables 1 and 2.

Fan Design Influences

Quality of Noise

The quality of the noise produced by a fan, as well as the decibel level, are strongly influenced by design factors such as airfoil type, angle of attack, aerodynamic shape of fan ring and support arms, and tip clearance. A good venturi-shaped fan ring reduces the noise level of a propeller fan while a bad one may actually increase it above that of no ring at all by inducing flow separation. The same phenomenon is responsible for rapid increase in noise level when tip clearances exceed 1 percent of the propeller diameter. Fan efficiency seems to have no direct bearing on the amount of noise produced. No doubt this is due to the very small amount of energy present in sound power, as can be seen from the sound level formula: Decibels $= 10 \log (I/I_o)$, where $I_o = 10^{-16}$ watts per sq cm. However, the same aerodynamic factors affect both similarly, a well-designed fan being quiet as well as efficient.

Method of Installation

Affects Noise

Inherent fan noise may be modified by the ambient conditions of the installation. When located within a building, sound waves are reflected back and forth from the walls, ceiling and floor, the portion absorbed being dependent upon the nature of reflecting surfaces. Hard walls reflect a maximum of noise and soft walls a minimum. A noise source located outdoors in space with no nearby reflecting surfaces dissipates its sound energy in all directions in the form of a sphere according to the formula: Decibel change $= 20 \log (S_1/S_2)$, where S = distance. Thus, doubling the distance from the noise source reduces the noise level 6.02 decibels. Reference to Fig. 2 reveals that a wall mounted exhaust fan will seem quieter within the room than will an intake fan.

Fan noise may also be modified by the method of mounting, panels and ducts often amplifying it greatly. Such amplification is difficult

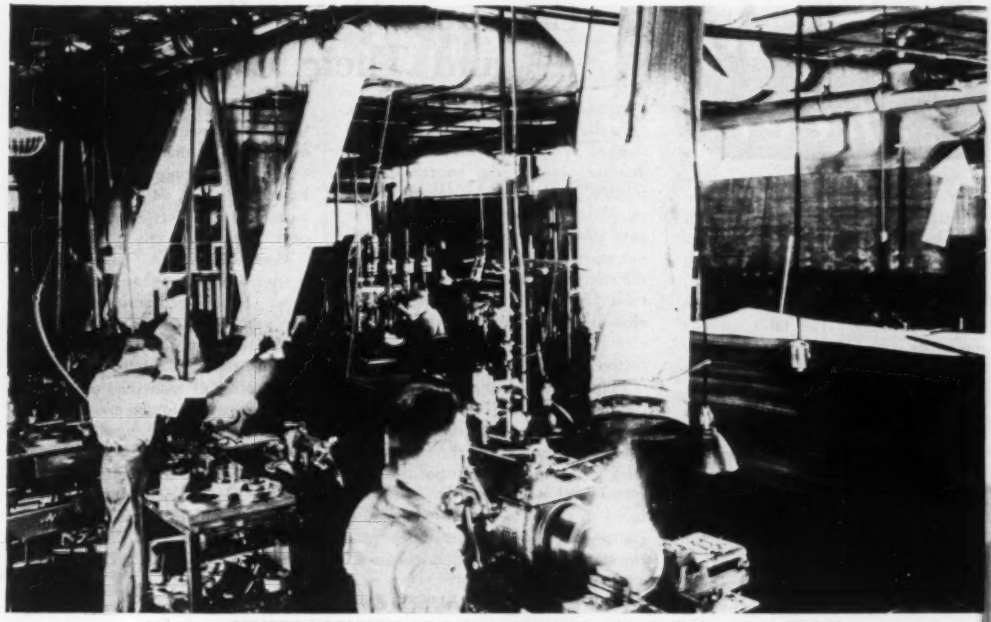


FIG. 3 — REMOTE LOCATION OF FAN (see arrow) for this ventilation system for high speed lathes reduces the noise. Note how oil fumes are picked up at their source, entailing a minimum of air movement and therefore low horsepower and noise level

to distinguish from fan noise because of identical frequency. Amplification by the mounting is possible over a wide range of frequencies because most fans have a wide noise spectrum. Obstruction or excessive restriction to the air flow is often responsible for increased noise. In this respect, it is well to remember that air flow at the fan inlet is steady in velocity and axial in direction, and at the outlet it is pulsating in velocity and helical in direction. Any obstructions which disturb this pattern will likely produce noise, the inlet flow being much more critical than the outlet in the case of very near obstructions.

The effects of "masking" certainly are of sufficient importance to merit attention. Masking takes place where two or more noises have nearly the same frequency. A noise when heard in the presence of another noise will have a higher threshold level and will therefore seem quieter than if heard alone. Take the case of a new power plant. The fans were turned on before the plant began operating and complaints were received from a nearby residential district. After the plant went into operation the fan noise was masked to the degree where it could hardly be distinguished as near as one city block. The fans then ran unnoticed.

Fan Horsepower Chief Factor?

Fan noise level has long been associated with rotor tip speed and properly so, since the higher the velocity with which the blade strikes the air the greater will be the sound pressure produced. Frequently, however, tip speed is taken as the chief factor affecting noise level when this is not the case at all; the chief factor for any given type fan is probably the fan horsepower.

It is reasonable to expect a 1 hp fan to produce more noise than a ¼ hp fan with the same tip speed; actually, the difference is approximately 7-12 decibels. Experience with a large number of fans bears out this relationship between fan horsepower and noise level and also confirms the author's contention that noise level varies more nearly with horsepower than with tip speed. Investigations of the National Advisory Committee for Aeronautics also indicate that sound pressure emanating from propellers tends to be proportional to torque and thrust (see NACA Tech. Note 747, Propeller Rotation Noise Due to Torque and Thrust.)

In view of the many variables involved in applying noise ratings of fans to actual ear response, it is unwise to rely wholly upon the decibel rating alone. In this respect a coded rating (such as "Q" suitable for quiet application, "C" suitable for commercial applications, and "I" suitable for industrial application), when stated by a reliable manufacturer, might be of greater value than a decibel rating. Certainly, such a rating gives a more accurate indication of the ear response.

99 NEW AMERICAN STANDARDS LISTED

NINETY-NINE NEW and revised American Standards are listed for the first time in the latest edition of the price list of American Standards published by the American Standards Association. 70 E. 45th St., New York City.

This list (available on request from the ASA) contains more than 1180 standard specifications, methods of test, and symbols and abbreviations.

DATA sheet

Common Motor Troubles and Their Causes

EASY-TO-DETECT SYMPTOMS will often indicate exactly what is wrong with a fractional horsepower motor. However, where general types of trouble have similar symptoms, it becomes necessary to check each possible cause separately. The table on this page lists some of the more common ailments of small motors, along with suggestions as to possible causes.

Most common motor troubles can be checked by some test or inspection. The order of making these tests rests with the troubleshooter, but it is natural to make the simplest ones first. For example, when a motor fails to start, one first inspects the motor connections, since this is an easy and a very simple thing to do.

In diagnosing troubles, a combination of symptoms will often give a definite clue to the source of the trouble, and hence eliminate other possibilities. For example, in the case just cited of a motor that will not start, if heating occurs, it offers the suggestion that a short or ground exists in one of the windings and eliminates the likelihood of an open circuit, poor line connection or defective starter switch.

Centrifugal starting switches, found on many types of fractional horsepower motors, occasionally are a source of trouble. If the mechanism sticks in the running position the motor will not start. On the other hand, if stuck in the closed position the motor will not attain speed and the starting winding quickly heats up. The motor may also fail to start if the contact points of the switch are out of adjustment or coated with oxide. It is important to remember, however, that adjustment of the switch or contacts should be made only at the factory.

Commutator type motors require more maintenance than the non-brush type. High speed series wound motors should not be used on long, continuous duty cycle applications because the commutator and brushes are potential sources of trouble. Gummy commutators and oil-soaked brushes can cause sluggish action and severe sparking. The commutator can be cleaned by using fine sandpaper. However, if pitted spots still appear, commutator should be reground.—HAROLD C. BODINE, Chief Engineer, Bodine Electric Co.

REFERENCE GUIDE TO PROBABLE CAUSES OF MOTOR TROUBLES

Motor Type	A. C. SINGLE PHASE				A.C. POLYPHASE (2 or 3 phase)	BRUSH TYPE (Universal, Series, Shunt or Compound)
	SPLIT PHASE	CAPACITOR START	CAPACITOR START & RUN	SHADED POLE		
TROUBLE	*PROBABLE CAUSES					
Will not start	1, 2, 3, 5	1, 2, 3, 4, 5	1, 2, 4, 7, 17	1, 2, 7, 16, 17	1, 2, 9	1, 2, 15
Will not always start, even with no load, but will run in either direction when started manually.	3, 5, 9	3, 4, 5, 9	4, 9		9	
Starts, but heats rapidly.	6, 8	6, 8				
Starts, but runs too hot.	7, 8	7, 8	7, 8	7, 8	7, 8	7, 8
Will not start, but will run in either direction when started manually — over heats.	3, 8, 9	3, 4, 8, 9	4, 8, 9		8, 9	
Sluggish — sparks severely at the brushes.						10,11,12,13,14
Abnormally high speed — sparks severely at the brushes.						15
Reduction in power — motor gets too hot.	8, 16, 17	8, 16, 17	8, 16, 17	8, 16, 17	8, 16, 17	13, 16, 17
Motor blows fuse, or will not stop when switch is turned to off position.	8, 18	8, 18	8, 18	8, 18	8, 18	18, 19
Jerky operation — severe vibration.						10,11,12,13,19

*PROBABLE CAUSES

1. Open in connection to line.
2. Open circuit in motor winding.
3. Contacts of centrifugal switch not closed.
4. Defective capacitor.
5. Starting winding open.
6. Centrifugal starting switch not opening.
7. Motor over-loaded.
8. Winding short circuited or grounded.
9. One winding open.
10. High mica between commutator bars.
11. Dirty commutator or commutator is out of round.
12. Worn brushes or weak brush springs.
13. Open circuit or short circuit in the armature winding.
14. Oil-soaked brushes.
15. Open circuit in the series or shunt winding.
16. Sticky or tight bearings.
17. Interference between stationary and rotating members.
18. Grounded near switch end of winding.
19. Shorted or grounded armature winding.

Sam Lewis' Page

. . . . . practical comment on pertinent problems

INFORMAL COMMENT on heating, piping and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, and a member of HPAC's board of consulting and contributing editors. Several lessons learned in the design, construction and subsequent operation of the mechanical equipment for a large public building are reported this month for the future benefit of the author and his friends.

FIVE LESSONS I LEARNED FOR USE IN THE FUTURE

I VISITED RECENTLY a very large, newly completed public building, the mechanical equipment for which I designed — aided by several members of my staff. The construction had been proceeding for several years. The job is commercially acceptable and has been paid for, but we could have done better. To tender such help to my friends as these lessons can give — and for punishment to myself — I set forth the following:

The space in the basement, fought for with the architects early in the design to accommodate pumps, compressors, generators, etc., proved too small. As the highly specialized apparatuses gradually were selected and installed, the owner's ideas expanded. As a result the machinery room is overcrowded and overheated.

Lesson No. 1 — We should have anticipated that much of the apparatus eventually would be installed in duplicate.

The machinery room is two stories high, with reinforced concrete joists to support the overhead construction. There is a maze of steam, return, compressed air, hot water, cold water, gas and refrigerant piping so extensive that it was installed at several different levels. To support this great weight of constantly expanding, contracting and vibrating pipes, there are hangers of widely varying length and size. The inserts built into the concrete as it was poured, quickly were all occupied, and so a costly series of subsidiary hanger supports were bolted to the joists.

Lesson No. 2 — I should have provided, from well-remembered earlier boiler room experiences, some such scheme as a grillage of steel beams over the entire machinery room from which the pipes and catwalks to reach the valves could be suspended.

Elevator lobbies in modern buildings are not easy to heat. I thought in this case that radiant heating in the concrete floor, and also in the ceiling, might prove acceptable. There were no pockets or recesses for radiators in the glassed entrances. Emergency exits for crowds of people, and revolving doors, are incompatible. The radiant heating works very well while the outside doors are closed. If, however, the wind blows cold and the outside doors are in constant use, the heat transfer from the radiant floor and ceiling to the inleaking air is too slow.

The single-thick-glass outside doors, devoid of weatherstrips and having wide cracks, are thoroughly inadequate and "unintelligent" heat barriers.

I know of one elevator lobby in a 25 story office building that must be entered directly from the street through a peanut-sized vestibule. Since the elevator lobby is also an emergency exit from a theater, no revolving doors may be installed. This building, criminally designed as far as ability to receive heat is concerned, is a constant curse to all who know it.

There are a great many similarly tall buildings that have the elevators a considerable distance from the entrances, so that a reservoir of warmed air can be maintained between outside doors and stairways and other shafts. Such buildings deserve emulation.

Lesson No. 3 — I should have insisted — all out — with the architect to gain a commodious vestibule room at every entrance, with a tremendous quick heat release in each vestibule such as might be gained by a fan-equipped convector (or unit heater). I should have urged much larger elevator lobbies.

We provided duplicate air compressors to serve the automatic temperature controlling devices. A couple of years after they were installed, some "genius" decided to tap the compressed air system for operating a flock of doors up in the building, and for controls and gages of a manufacturing process. Of course, this relatively tremendous demand for air overtaxed the original compressors, and then, to add insult to injury, they introduced lubricating oil into the air lines!

Lesson No. 4 — No rule is more helpful than the one that holds that compressed air for temperature control shall be limited just to that.

I know that heat transfer surfaces (such as are installed in tanks to heat water with steam or to cool water with some other liquid) must eventually be removed and cleaned. We showed a dotted line area on our drawings at the business end of each converter so as to reserve pull-out clearance. We showed offsets and unions and valves in the connecting piping to promote easy removal of the heating elements for cleaning. However, the owner — without reference to me — installed in this clearance space a heavy steel tank that most effectively will require a tremendous and costly operation when maintenance time rolls around

and the heat transfer coils must be cleaned.

Lesson No. 5 — Let me remember on the next project to put up a still more determined argument for adequate space for mechanical equipment and for its maintenance!

MORE IDEAS ON THAT HOSPITAL PROBLEM

SOME MONTHS AGO, "C.H.B." complained — in a published question — about the heating of the surgery wing of the hospital of which he is the maintenance manager. This new wing has convector radiation, while the other parts of the hospital have old cast iron radiators. He said that the average temperature in the surgical department was 68 F when the other wings had a temperature of 80 F or higher, and that the convectors cooled very quickly whenever the oil burner ceased operation.

I suggested possible conversion of the entire plant to mechanically circulated hot water, provided that the cast iron radiators have top-connected sections so that hot water could be used in them. If the old radiators are not adaptable to hot water, I suggested transposing some of the convectors and radiators between rooms and wings, so that each major room at least could have some of each kind of radiation. This might equalize things generally at relatively little cost.

"C.H.B." consulted a local contractor, whom he quotes as follows: "Hot water would have such a strong gravity pull on a three-story system that it would be apt to get air, and all the water would siphon back to the boiler."

One but can deduce from this quotation that the local contractor did not understand my suggestion, or was prejudiced by old-time gravity circulation hot water systems.

Let it be understood that if the system were converted to hot water, with an expansion tank and mechanically induced circulation, the boiler and all of the piping and all the heat transmitters would be full of water. The expansion tank would be placed at a level higher than the highest radiation, or would be placed in the boiler room with an air cushion in its upper part. There would be no chance for air to enter the system and no siphonage could occur.

A small electric pump in the boiler room would keep the water circulating throughout the hospital and the temperature of all the water to both old and new wings would be the same at all times. Normally, the pump, running continuously, would recirculate the returning water from the heat transmitters. Occasionally, under thermostatic control, only enough hot water from the boiler (replaced with recirculated water) would pass to the pump to deliver the desired amount of heat. The operation of the oil burner would respond to an aquastat in the boiler water, keeping the water temperature to, say, 230 F. This scheme works beautifully, and has insured an even temperature throughout the building, as well as saving of fuel, in many cases.

Another possibility occurs to me. It is quite likely that the convectors in the surgery wing are connected on a two-pipe system and that they would work admirably on hot water. It may be possible therefore to convert the heating of only the surgery wing to hot water, leaving the older parts of the hospital on low pressure steam as at present. A special connection can be threaded or welded into the boiler about 4 in. below the normal water level so as to allow the same boiler to furnish both hot water and steam at the same time.

The water in the boiler at this point will be at about 212 deg, and if allowed to flow out to the radiators in the surgery wing and if pumped back into the boiler near its bottom would heat the surgery convectors. The present rapid fluctuations in temperature would disappear. An expansion tank would be necessary. I would like to know the location of the thermostat that now stops and starts the oil burner before suggesting further details for this scheme.

USE "CHEAP DOLLARS", BEARDSLEY RUML SAYS

INDUSTRIAL MANAGEMENT was recently urged by the well-known economist, Beardsley Ruml, to use "cheap dollars" created by the excess profits tax in development of production opportunities which would not normally appear prudent. His recommendations were presented in an address before the annual meeting of the Gas Appliance Manufacturers Association, in Chicago.

Charging that the payment of an excess profits tax by a company in 1952 will be "a presumption of managerial inadequacy," Mr. Ruml stressed that "cheap dollars" could be expended for production purposes on everything but those projects which require new capital investment not subject to accelerated depreciation.

"Cheap dollars are those which, if not spent, will be taxed at high marginal excess profits rates," he said. "Expensive earned dollars are those which are taxed at ordinary rates."

Under the excess profits tax law, he explained, the marginal rate is 77 percent, giving the "cheap earned dollar" a value of only 23 cents. The ordinary rate is 47 cents; so the "expensive earned dollar" is worth 53 cents, more than twice as much as the cheap dollar.

Besides its inflationary consequences, the existence of cheap dollars "makes prudent many business activities that would not be prudent except for the fact that the dollars expended are cheap," said Mr. Ruml.

"Research on new products and new designs, tooling up for new markets, reorganization of production flow, testing of old and new products under problematical conditions, importation of experimental skills, materials and machines are now in order," said the economist.

"In fact," he added, "any current expense for economy or improvement of product that seems to be too speculative under ordinary tax circumstances may prove to be prudent for a management with 'cheap dollars' at its disposal."

In justifying his tax philosophy, the economist told the GAMA meeting:

"It is not only proper, but it is the duty of management to minimize by all lawful means the tax consequences of business decisions. It is a duty because management is a trustee for all parties at interest in the health and growth of the business — stockholders, workers, vendors and customers.

"The individual may, if he so desires, pay more than the law requires. The injury is to himself alone. But management is not a free person. It is acting for others who depend on the business for products, wages, markets and income."

QUESTION of the Month

QUESTIONS ON heating, piping and air conditioning asked by HPAC's readers are answered here each month. We hope you find these practical comments of regular interest. Why don't you contribute either a question, or an answer to a published question, for next month's issue? We'll be glad to hear from you. Just address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Illinois.

EXPLAINS GERMAN METHOD OF HEATING DESIGN

IN THE NEW Question of the Month in the April HPAC, "M.A.Y." said that during the past three years he had worked with several foreign designers (German, Danish and Japanese) of heating systems, and without exception they calculated heat losses, pipe sizes, etc., by the Rietschel-Brabbee "Heizungs-und Luftungstechnik" method. "M.A.Y." asked if this method has advantages over that shown in the Guide, published by the American Society of Heating and Ventilating Engineers, and asked for comment on the method and its advantages or disadvantages.

The Rietschel-Brabbee method is the generally accepted and used method in Germany and many other countries in Europe. I personally used it for approximately 15 years while working in Berlin.

Heat Loss Computations

The heat loss computations are somewhat different than we use in this country:

1) Infiltration is included in coefficients of transmission. This is, in my opinion, preferable to our method of crack length computations.

2) Safety factors for exposures are mandatory and not optional.

3) Safety factors for corner rooms vary from 5 to 10 percent.

4) Safety factors for prevailing wind are used only when there is an open space in front of the building of not less than 120 ft.

5) Finally, allowances are made for pickup (for radiators). Standard practice is also not to use less than 2.3 Btu per cu ft for rooms in dwelling buildings.

The Rietschel method of heat loss computations is a German industry standard, DIN4701, and is the only method which is recognized in courts.

This method gives good and safe results, as does the method given in the Guide. Whether the Rietschel method offers some advantages is not, in my opinion, as important as to have a uniform method throughout this country. I recommend, therefore, that the ASHVE method be adopted as an American standard.

Pipe Size Calculations

Rietschel developed similar methods for computing pipe sizes for high and low pressure steam and for hot water heating systems.

In steam heating, we are much ahead of German methods, and moreover the design of steam heating systems cannot proceed solely in accordance with theoretical computations because of the presence of condensate in steam pipes. There are, for example, experimental limitations to the velocity of steam in pipes depending on whether condensate flows with the steam or in the opposite direction, and whether the steam pipes are horizontal or vertical.

Under these circumstances steam pipe computations by the Rietschel method do not seem to me to be of great value for U.S.A. practice.

The sizing of hot water heating piping is the best part of Rietschel's method. This method is more elaborate than the one presented in the Guide.

Rietschel explains in detail several hot water heating systems:

a) Two pipe gravity up feed system.

b) Two pipe gravity down feed.

c) Two pipe gravity down feed considering additional head produced by temperature drop in piping system due to heat losses. Rietschel shows that temperature drop in the piping from the boiler (say 190 deg) to the entrance of a radiator (say 180 deg) creates additional head which should be added to the gravity head. This method requires smaller pipe sizes than does a standard gravity system.

d) One pipe gravity down feed system.

e) One story two pipe hot water systems where the center lines of the boiler and the radiators are approximately at the same level. The head is produced by temperature drop in the piping due to heat losses.

f) Forced circulation heating systems.

All systems mentioned in "a" to "e" above are gravity systems. Rietschel gave particular attention to the development of gravity methods, because gravity hot water is the most popular method of heating buildings in Germany. The reason for the preference of gravity systems (as long as buildings are not too big for gravity) lies in the fact that practically all heating boilers in Germany are hand-fired (magazine type) boilers.

There is, of course, a certain danger in using a circulator with a hand-fired boiler. If the circulator stops for any reason, the boiler will start steaming in a very short time, sometimes in a few minutes. Although hot water systems in Germany are generally equipped with open expansion tanks, and the expansion lines are sized in accordance with the code, big enough to take care of such an emergency, the throwing out of steam through the expansion tank is accompanied by a terrible noise and rattling which can scare the dickens out of the tenants. (Safety valves on heating boilers are not permitted.)

Computing Hot Water Piping

The Rietschel method of computing hot water heating pipe sizes consists of two parts:

1) Assumption of pipe sizes.

2) Rechecking of the selected pipe sizes.

The assumption is made for gravity systems by figuring first the available gravity head for the selected

STILL WANTS IDEAS ON FILING DATA

You are invited to answer the following questions from a reader of HPAC. Please address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"I know this question has been asked before in these columns, and I have read answers to it which have been helpful to me and which have given me ideas that I have used. But I still haven't found the system to answer all my needs.

"What I am interested in is the best way of filing, in a small engineering office, technical information from articles in HPAC and other magazines; data from manufacturers of equipment used in heating, piping and air conditioning work; and ideas and data from other sources.

"By 'the best way of filing', I mean the method that takes the least time and trouble not only to put the data in the right place originally but to find it when it's wanted."—G.W.

temperature drop (36 F) plus additional head produced by heat losses in piping system (for methods "c" and "e").

This additional head (for the assumption of pipe size) can be taken from tables. Fifty percent of the total is deducted for friction losses in valves, fittings, radiators, etc. and the remaining 50 percent is divided by the length of the longest circuit to obtain the pressure drop per 1 meter (3.3 ft).

Shorter circuits have of course a higher pressure drop.

Pipe sizes are then selected from the Rietschel tables, which are more elaborate than those given in the Guide.

For forced circulation, the procedure is the same with the exception that pump head is selected. Fifty percent of this head is deducted for fittings and valves, etc. (as explained above) and the remaining head is divided by the length of the longest circuit. Pipe sizes are then selected from tables for forced circulation. The temperature drop for forced circulation is the same as for gravity, 36 F.

Having thus assumed the pipe sizes, which are close enough for estimating purposes but not for actual installation, German engineers proceed then to recheck the selected pipe sizes by exact and detailed computation of all circuits.

This procedure has the following advantages:

1) Pipe sizes computed by the preliminary method are generally too big, and substantial savings can be accomplished by exact computations.

2) Systems properly computed require very little balancing.

3) Proper computations are necessary because the direct return piping arrangement is generally used. Reversed systems are an exception, even for large installations.

Actually, in 15 years I had only one opportunity to design a large size reversed system. All others had the direct return arrangement. Reversed systems are more expensive for large installations.

A system with the direct return arrangement cannot be balanced by balancing fittings alone. It should be properly computed.

Also, because of the direct return arrangement the selected pump heads are always low, generally not exceeding 60 mil-inches per ft of actual circuit length. (This is 50 percent of total head.)

The smallest pipe branch used is ⅜ in. No difficulties have been experienced with ⅜ in. branches if properly installed and reamed.

The rechecking of assumed pipe sizes includes computation of friction losses in elbows, fittings, valves, radiators, etc. The coefficients are given in velocity heads. This is much more convenient than elbow equivalents.

Example: Return connection to a radiator:

Half a radiator	1.5 velocity head
2 elbows (¼ in.)	3 velocity heads
1 tee	1.5 velocity head
	6 velocity heads

For the velocity in particular branches, the friction loss equal to six velocity heads can be taken conveniently from a table, then added to the friction of the pipe.

If such computations show that less head has been used up than available, pipe sizes are reduced and computations repeated.

Every radiator circuit is thus computed until it becomes evident that the required size of radiator branch will be ⅜ in. or the minimum size.

Should Method Be Used Here?

Having explained the Rietschel method for sizing piping for hot water heating systems, let us see what this method can do for us in this country.

In the first place, the Rietschel method and the method as explained in the Guide are in principle the same. The differences in details are not very substantial or important. The main difference is in application.

In this country we do not use gravity systems as a rule, and we also prefer not to use the direct return pipe arrangement, because it is simpler to design forced circulation systems with the reversed pipe arrangement.

The chances are that a forced circulation reversed system will properly function without exact rechecking of each and every radiator circuit. But if somebody decides he wants to recheck exactly all the circuits, he can do it nicely and conveniently with the information given in the Guide, whether the system is gravity or forced circulation, and whether it is a reversed or direct return system.

The only information missing in the Guide is that for computation of additional heads due to heat losses in the piping system. But, actually, we do not need this information because we can design a safe and well functioning forced circulation system which will require much smaller pipe sizes than any gravity system, even improved by additional head as explained above.

Thus, I cannot see any advantage in using the Rietschel-Brabbee method for American practice.—E. A. KAPLUN, Consulting Engineer.

AIR CONDITIONING CLASSED AS REAL PROPERTY

THE NATIONAL PRODUCTION Authority, U. S. Department of Commerce, has distributed to the department's field offices a list of motion picture theater equipment classified as real or personal property, for use as a guide in determining the cost of alteration or construction of theaters in connection with the construction limitation order M-4.

Air supply and conditioning equipment both of the centralized type with ducts and unit conditioners without ducts are classified as real property, according to the list.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

Climatology as an Aid in Heat Pump Design

By George S. Smith*, Seattle, Wash.

SUMMARY—The major portion of the heat supplied by a heat pump is drawn either from the air or the outer layer of the earth's crust. Thus the design of this type of heating plant must depend upon temperatures and temperature changes at various seasons of the year. The ability of the medium in question to absorb, hold and conduct heat must also be known. To determine such information accurately would usually require a considerable amount of experimental work at the locality in question.

This paper presents a considerable amount of such data collected in the Pacific Northwest area, and attempts to relate it to the corresponding U. S. Weather Bureau records in such a way that such weather statistics for any locality might be used to determine much of the necessary information. It is also suggested that those carrying on research of a similar nature in other areas might use their data to check the methods proposed, and perhaps suggest additional or improved ones. A final accumulation of such results from diversified sources and areas will prove invaluable for use in designing a heat pump in any locality.

THE introduction of the heat pump in the field of space heating has created a demand for information not generally available. In using any one of the natural heat sources (air, surface or ground water, and the soil) a knowledge of some of the characteristics of the source used is of major importance. A few studies of temperatures and other factors peculiar to the location of the study have been made and others are now in progress.

Eventually the accumulation of information from various parts of the country will permit interpolation of design data sufficiently accurate for most design problems. Fortunately the U. S. Weather Bureau records, which are usually available, will be invaluable as a source of information for any locality under consideration, or to aid in interpolating the results of studies from other localities.

This report contains a considerable quantity of soil temperatures and other data collected in the Pacific Northwest area, and will suggest methods by which Weather Bureau data may be used in heat pump design where the desired type of information is not available and would require much expense and time to obtain.

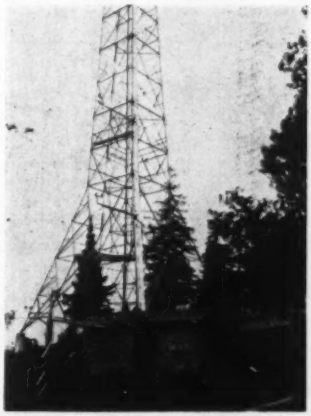


Fig. 1.— University of Washington Climatology Recording Station

Experimental Apparatus Used

Most of the data presented were obtained from three temperature stations. The major station, situated on a golf course at the University of Washington, comprises 13 resistance-type temperature measuring elements spaced from one centimeter to 15 meters below the surface of the soil. Air temperatures are also recorded by similar means from near the surface to a height of 150 ft above the ground. The temperatures are recorded by means of automatic recorders. Recently apparatus to record wind velocity and moisture content of the air, as well as heat flow into the soil, was added, making this the University Climatology record-

*Professor of Electrical Engineering, University of Washington.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Portland, Ore., July, 1951.

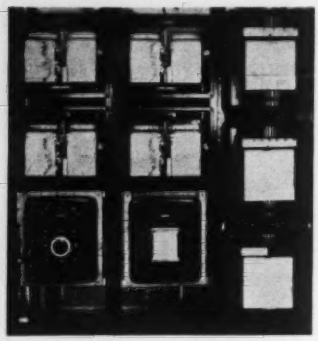


Fig. 2 — View of a portion of the recording apparatus

ing station under the supervision of the Climatology Department. Fig. 1 shows a view of the Climatology Station and Fig. 2 shows the recording equipment. Fig. 3 indicates the positions of the soil thermo elements and heat-flow units.

Two other temperature stations use copper-constantan thermocouples spaced at depths of one, two, three, four, six and ten feet below the surface of the ground. In addition to the enamel and cotton covering, the thermocouple wires are protected by special rubber paint, and a coat of glyptol varnish. They terminate on an enclosed terminal block with metal terminal jacks. These jacks have tapered holes to match tapered plugs from which the circuit is carried by copper and constantan wires to a second couple on the meter. A portable potentiometer is used to take the readings. The second couple at the meter is taped to the bulb of a mercury thermometer, and the two are carefully encased in a felt covering. The temperature of the couple on the meter is recorded for each thermocouple reading. Readings at these two thermocouple stations are taken weekly.

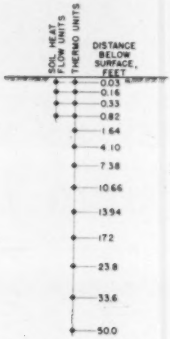


Fig. 3 — Positions of subsurface temperature and heat-flow elements

Weather Bureau records from Seattle, Portland, Spokane, and Boise stations were relied on for much of the remaining information necessary.

Temperature Information

The temperatures recorded every 12 min at the Climatology Station (Station A) were averaged for each day. The average air tempertures and soil temperatures at several depths over a period of two years are shown plotted in Fig. 4. A similar plot of maximum and minimum air temperatures as well as several sub-surface temperatures which were taken at one of the 10-ft depth stations is shown in Fig. 5. This station, designated as Station B, is situated about a quarter mile from Station A, and near the site where a series of tests on ground coils were run. Fig. 6 presents a third set of curves taken at Station C situated in the back yard of a typical town lot about two miles north of the University campus.

There is a striking similarity in the temperatures at the various stations for a given depth. The temperatures at one centimeter depth follow the average air temperature rather closely. However, the continuously recorded temperatures at this depth often indicate a soil temperature several degrees higher than the air temperature a short distance above the surface. An unusually warm or cold day will initiate a pronounced temperature wave, conducted rather slowly into the ground, which will appear later at a greater depth with a somewhat reduced maximum. At shallow depths such thermal waves might occur several times a day; at somewhat greater depths they will usually occur daily and at still greater depths less frequently up to the yearly variations. Fig. 7 presents an interesting method of

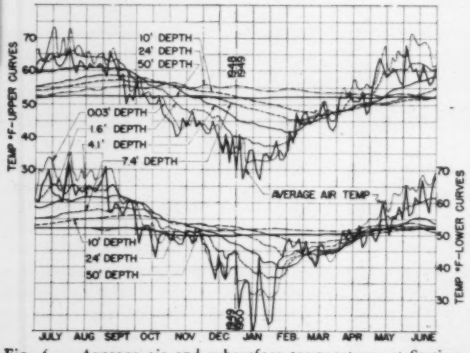


Fig. 4 — Average air and subsurface temperatures at Station A taken at the Climatology Recording Station over a period of two years

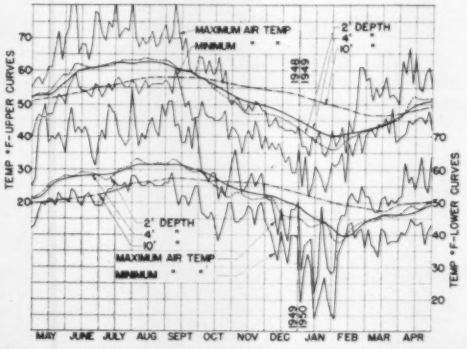


Fig. 5 — Maximum and minimum air with subsurface temperatures at Station B taken near ground-grid site, over a period of two years

plotting the temperatures recorded at Station A. The lag of the change in temperature at the various depths is clearly shown. There appears to be, in effect, lagging of at least a year even at the 50-ft level, as indicated by the rise of the 50 F temperature line nearly a year after an unusually cool winter. Also the effect of the unusually wet summer of 1948 is indicated by the greater depth of temperature travel.

Use of Temperature Records

General Design Factors

Temperature records such as have been described are very useful in heat pump design, especially where ground grids are used as heat sources or sinks. The average temperature at the start of the heating season can be found for any depth at which the grid might be placed, assuming that the soil has regained normal temperature conditions during the summer. If the soil has not attained normal temperature conditions the ground grid may not be adequate or it may be of such design that a new lower average soil temperature has been established. In colder climates there is an advantage to be gained by placing the tubes rather deep to gain the advantage of the temperature lag with respect to the atmosphere above the surface. In rather warm climates, and especially where there is considerable sunshine during the heating season, a grid only a foot or two below the surface will gain the advantage of the sun's radiated heat and yet avoid the disadvantage of short cold spells.

Soil Heat Absorption Due to Solar Radiation

The amount of heat available for a ground grid is probably limited to the heat absorbed by the soil from the sun's radiation, plus that precipitated from the atmosphere and carried in by the rain. The solar heat thus supplied to the earth, per square foot of surface may be closely approximated by calculation.

The temperature for the soil at one-centimeter depth, as indicated in Fig. 4, (which will be called the surface temperature) varies rather erratically, but over a year's time it follows through a complete cycle resembling a sine wave with many harmonics. The fundamental sine wave of one complete cycle per year which would produce the same heating or cooling effects in the earth can be closely approximated by the following procedure:

At some depth, usually 30 to 50 ft below the surface of the ground, the soil remains very nearly at a constant temperature equal to the average air temperature above the surface. This constant temperature will be called the base temperature. The difference between the base temperature and the surface temperature will cause heat migration. Over that portion of the year when the surface of the soil is warmer than the base temperature, the average difference in temperature causing heat flow is obtained by dividing the summation of the differences between each day's average surface temperature and the base temperature by the number of days involved. The average amplitude of the positive or negative half of a sine wave is 0.636 of its maximum amplitude. Dividing the computed average difference in temperature by 0.636 will give the maximum amplitude of the equivalent sine wave of temperature changes, which in this case will have a time period of one year.

A solution of Fourier's differential equation[1] for temperature variations of this type may be stated as follows:

$$\frac{Q}{A} = k T_o \sqrt{\frac{2P}{\pi \alpha}} \qquad (1)$$

where T_o is the maximum value of the equivalent sine wave derived as was explained and P is the period or duration of the total wave which would be twice the length of the half cycle during which the earth is absorbing heat. With the soil conductivity k and diffusivity α known, the heat absorbed due to the sun's radiation per unit area can be readily calculated.

If, however, the mean temperature of the earth, at least that portion

[1]Exponent numerals refer to Bibliography.

Symbols

A = area — square feet.
a = thermal diffusivity = $k/c\ \rho$ — square feet per hour.
c = specific heat — Btu per (pound) (Fahrenheit degree).
k = thermal conductivity — Btu per (hour) (square foot) (Fahrenheit degree per foot).
Q = heat flow — Btu.
P = time for one cycle of sinusoidal temperature change — hours.
T_o = maximum positive (or negative) value of the sinusoidal temperature change — Fahrenheit degrees.
ρ = density of soil in pounds per cubic feet.
t = time in hours.
x = distance in feet.

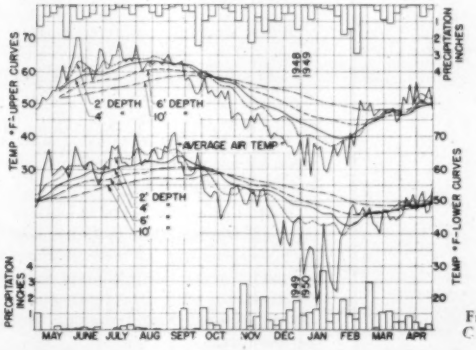


Fig. 6 — Average air and subsurface temperatures at Station C taken on a typical city lot over a period of two years.

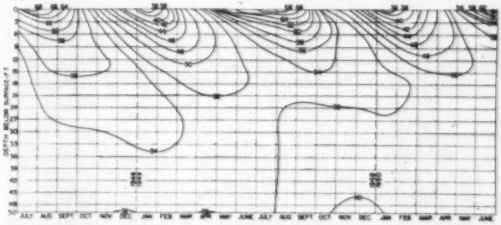


Fig. 7 — Temperature — depth — time curves — Station A Constant temperature curves indicate lag of temperature changes with depth. The effect of moisture on the depth of heat penetration is also indicated

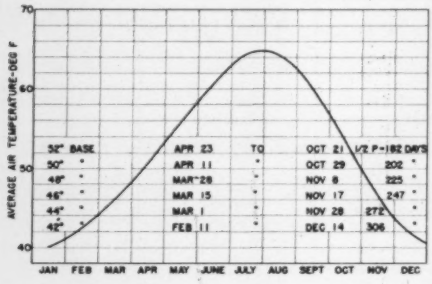


Fig. 8 — Monthly mean air temperatures through the year (Seattle). The various temperature levels illustrate the relative amplitudes and periods of the positive half of the sine wave temperature variation

Table 2 — Calculated Rainfall Heat Absorbed by Soil

Month	Rainfall inches	Lb Water per Sq Ft	Average Air Temp	Btu added per square foot Based on Average Soil Temp of 40 F	44 F	46 F	48 F	50 F
Jan.	4.94	25.7	40.8	20				
Feb.	3.89	20.2	42.8	56				
Mar.	3.05	15.8	46.4	100	38	6		
Apr.	2.38	12.4	51.1	140	88	63	38	14
May	1.87	9.7	56.6	160	122	103	83	65
June	1.33	6.9	61.4	150	120	106	93	79
July	0.63	3.3	65.5	84	71	64	58	51
Aug.	0.70	3.6	65.5	92	74	70	63	56
Sept.	1.77	9.2	60.3	187	150	131	113	95
Oct.	2.84	14.8	53.7	200	148	114	84	55
Nov.	5.03	26.2	46.8	178	73	21		
Dec.	5.60	29.1	42.6	75				
TOTALS	34			1442	884	678	532	415

above and below the grid for some distance, is lowered by the presence of a ground grid, then the earth will more readily absorb radiation from the sun and will do so over a longer period of time. In order that the maximum ordinate as well as the period of the new equivalent sine wave value may be determined, the following procedure may be used:

Fig. 8 shows a plot of the average air temperatures for each month from the Seattle Weather Bureau's 1900 to 1950 records. Using 52 F, which is Seattle's average yearly temperature, as the zero for the resulting sine wave, the heating and cooling periods are almost exactly six months each. If, because of a ground grid the average ground temperature was lowered, say, to 50 F, then the heating portion would have a longer period, from April 13 to October 28. The maximum value of the equivalent sine wave for the heating portion of the cycle would be found as previously specified using 50 instead of 52 F as the mean yearly average and between the dates indicated. The total period or duration of the cycle would of course be twice the value found for the positive half and thus more than one year in length since the presence of the ground grid has altered the normal cycle. Several other base temperatures are also indicated on the diagram.

Table 1 — Solar Heat from Sun Radiation

Year	Base Temp Start and Finish Dates	Temp Difference Between	Total Deg Days Difference	½ Period Days	Average Difference Degrees	T_o Avg/0.636	Q/A Btu/Sq Ft
1949	42 F Feb. 11 Dec. 14	Surface and Base 71% (Max. Air and Base)	4756 4610	306 306	15.5 15.0	24.4 23.6	9550 9250
	44 F Mar. 1 Nov. 28	Surface and Base 71% (Max. Air and Base)	4187 4070	272 272	15.4 14.9	24.2 23.5	8950 8690
	46 F Mar. 15 Nov. 17	Surface and Base 71% (Max. Air and Base)	3604 3520	247 247	14.5 14.2	23.9 22.4	8420 7900
	48 F Mar. 28 Nov. 8	Surface and Base 71% (Max. Air and Base)	3091 3070	225 225	13.7 13.6	21.6 21.4	7260 7200
	50 F Apr. 11 Oct. 29	Surface and Base 71% (Max. Air and Base)	2644 2560	201 201	13.1 12.7	20.7 20.0	6660 6440
	52 F Apr. 23 Oct. 21	Surface and Base 71% (Max. Air and Base)	2258 2230	181 181	12.4 12.3	19.6 19.4	5910 5860
1950	42 F Feb. 11 Dec. 14	Surface and Base 71% (Max. Air and Base)	4130 4100	306 306	13.5 13.4	21.2 21.1	9920 9870
	44 F Mar. 1 Nov. 28	Surface and Base 71% (Max. Air and Base)	3553 3550	272 272	13.1 13.0	20.6 20.5	9080 9030
	46 F Mar. 15 Nov. 7	Surface and Base 71% (Max. Air and Base)	3054 3100	247 247	12.3 12.5	19.4 19.6	8140 8220
	48 F Mar. 28 Nov. 8	Surface and Base 71% (Max. Air and Base)	2656 2720	225 225	11.8 12.1	18.5 19.0	7400 7600
	50 F Apr. 11 Oct. 29	Surface and Base 71% (Max. Air and Base)	2310 2340	201 201	11.4 11.6	18.0 18.3	6820 6920
	52 F Apr. 23 Oct. 21	Surface and Base 71% (Max. Air and Base)	1904 1990	181 181	10.5 11.0	16.5 17.3	5900 6190

Soil Constants used for 1949
Moisture 10% = 0.018 k = 0.544 = 93 dry
Soil Constants used for 1950
Moisture 15% = 0.0175 k = 0.65 = 93 dry

The soil-surface temperatures are not normally available and determining them would require time and expense. There should, however, be some fairly definite relation between the maximum daily air temperatures, and the average daily surface soil temperature for that particular day. This substitution will of course give only an approximation of the true value, but will in general give results accurate enough for heat pump design purposes. Such information is readily available at any Weather Bureau station.

When temperature differences were calculated by using both maximum air and average surface values against the base temperature, the average ratio of the differences was found to be 0.71 to 1. Thus when using maximum air temperatures, the differences must be multiplied by 0.71.

Table 1 shows the actual calculated heat absorption from recorded surface temperatures as well as those estimated using the maximum daily temperatures with the proper multiplying factors. Fig. 9 shows a plot of these data.

Table 3 — Percent of Heat Pump Operating Time, Seattle, Wash.

Month	Degree Days	Percent of time Operating[a]	Hours of Operation	Percent of Time Operating			
				House A	House B	House C	House D
Jan.	763	70	520	29		61	93
Feb.	635	65	437	31	54	50	69
March	590	54	400	22	35	33	61
Apr.	434	41	295	19	22	31	38
May	289	26	193	10	9	9	30
June	157	15	108	3	7	4	14
July	63	6	45	0.6	3	1	3
Aug.	68	6	45	1	3	1	28
Sept.	169	16	115	3	5	8	30
Oct.	365	33	245	11	27		
Nov.	556	51	367	22	40	43	42
Dec.	704	65	445	27	39	61	81
TOTALS	4793		3215				

[a]Based on average coldest January day for 10 years taken every other year.
Degree-Day Average coldest Day = 35

Table 4 — Percent of Heat Operating Time, Portland, Ore.

Month	Degree Days	Percent of Time Operating[a]	Hours of Operation	Percent of Time Operating	
				House E	House F
Jan.	781	68	505	61	59
Feb.	613	59	396	54	52
Mar.	536	47	349	45	35
Apr.	366	33	237	25	24
May	229	20	149	13	
June	105	9	64	7	
July	26	2	15	8	
Aug.	28	2	15	12	
Sept.	105	9	64	15	
Oct.	293	25	186	20	
Nov.	537	48	346	38	
Dec.	721	63	470	46	58
TOTALS	4340		2796		

[a]Based on average of the coldest January day for 7 years, taken every third year.
Degree days for average coldest day = 37

Detailed Information on Houses

House	Gross Heated Cu Ft	Unit	Heat
A	10904	3 hp	Well
B	39000	2-5 hp	G. Grid
C	13000	3 hp	Lake
D	33500	5 hp	Spring

Detailed Information on Houses

House	Gross Heated Cu Ft	Unit	Heat Source
E	10300	3 hp	Well
F	23000	5 hp	Well

Soil Heat Absorption Due to Rainfall

In many localities, especially in the Pacific Northwest, the rainfall probably carries a considerable amount of heat into the soil and the ground moisture due to rain will greatly increase the soil's capacity to maintain this heat energy in storage. Any accurate method for determining the amount of heat energy derived from this source would require a great deal of study and time. Table 2 presents a method of approximating rainfall heat additions by using the Seattle Weather Bureau's 50-year averages of rainfall for each month together with the average temperature for the corresponding month.

The amount of heat added by rainfall can be readily computed by using as data the weight of rainwater falling on each square foot, and the difference between the average air temperatures and the assumed average or base ground temperature. This method assumes that the temperature of the rainwater is at the average air temperature. Such an assumption is probably quite in error during the winter months because a rainy spell will raise the air temperature considerably above the average for the month, while a cold dry spell will generally lower it. Fortunately such an error will result in more heat addition than the calculations indicate. The computed heat values in Table 2 are plotted in Fig. 9.

Validity and Use of Calculated Results

The total calculated heat added per year per square-foot area of soil for any assumed average ground temperature will then be the sum due to the sun's radiation plus that added by the rainfall.

As crude as this method of calculating the yearly heat available in the soil for heat pump use may appear, it does offer some guidance until experience may prove the method too pessimistic. In fact, under the conditions assumed, the soil beneath each square foot of surface will hold little more heat than is indicated by the curves in Fig. 9.

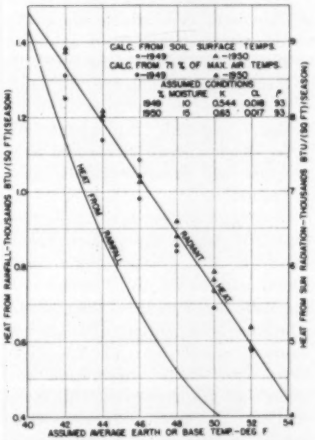


Fig. 9 — Plot of soil heat absorption from the sun's radiation and from rainfall

As an example, assume that a ground grid causes the average of the soil temperatures from the surface to a depth well beyond which the grid will draw heat, to drop to 48 F. From Fig. 9 the solar radiation would have supplied approximately 7450 Btu, and rainfall would have added 530, or a total of 7970 Btu per sq ft of soil area. From Figs. 4, 5 or 6, the average soil temperature over the same range of depth would be about 55 F at the start of the heating season, about October 1. This would result in a 7-deg average temperature differential to promote heat movement. Assuming soil constants found at the location of these tests, we would have the dry soil density as 93 lb per cu ft, and a moisture content at this time of about 15 percent. If the specific heat of the dry soil is 0.2 and for the water contained is unity, then the heat in one cubic foot of dry soil is $93 \times 7 \times 0.2 = 130.2$ Btu while that in the moisture content will be $93 \times 0.15 \times 7 = 97.6$ or a total of 227.8 Btu. Dividing the total absorbed heat per square

Table 5—Percent of Heat Pump Operating Time, Spokane, Wash.

Month	Degree Days	Percent of Time Operating[a]	Hours of Operation	Percent of Time Operating	
				House G	House H
Jan.	1152	73	542	74	84
Feb.	929	65	437	64	70
Mar.	757	48	356	47	48
Apr.	492	32	230	27	30
May	281	17	126	13	13
June	114	7	50	8	12
July	21	1	7	9	5.5
Aug.	37	2	14	11	4
Sept.	187	12	86	9	18
Oct.	482	31	230	12	33
Nov.	821	53	380	43	62
Dec.	1061	67	498	45	73
TOTALS	6334		2956		

[a]Based on average of the coldest January day for seven years, taken every third year.
Degree days for average coldest day = 51

Table 6—Percent of Heat Pump Operating Time, Boise, Idaho[a]

Month	Degree Days	Percent of time Operating[a]	Hours of Operation	Percent of Time Operating					
				House I	House J	House K	House L	House M	House N
Jan.	1097	62	461	64	66	55	85	64	75
Feb.	854	53	356	54	42	35	55	75	44
Mar.	694	39	290	36	24	23	24	43	37
Apr.	438	25	180	17	19	11	8	17	18
May	208	11	82	5	7	4.5	2.3	1	5
June									
July									
Aug.									
Sept.	87	5	36	0.4	3	4	2	—	1.3
Oct.	406	23	170	21	48	11	34	27	30
Nov.	728	42	302	26	36	24	42	36	36
Dec.	1010	57	424	41	48	42	57	55	57
TOTALS	5522		2301						

[a]Based on the average coldest January day for seven years taken every third year.
Degree days of average coldest day = 57

Detailed Information on Houses

House	Gross Heated Cu Ft	Unit	Heat Source
G	17660	5 hp	Ground Grid
H	10180	3 hp	City Water

Detailed Information on Houses

House	Gross Heated Cu Ft	Unit	Heat Source
I	9400	3 hp	Well
J	14300	5 hp	Well
K	10300	5 hp	Well
L	17500	5 hp	Well
M	18900	5 hp	Well
N	24100	7½ hp	Well

foot of surface by the heat contained per cubic foot will give a required column of soil 35 ft below the surface. At this depth the normal soil temperature changes but little throughout the year, indicating that the normal heat travel below this depth is negligible.

The total annual heat available from an area below which a ground grid is operating is probably somewhat greater than that indicated by Fig. 9. Since the ground grids are placed comparatively near the surface, the temperatures within a considerable distance from the grid will, in general, be far below the average soil temperatures especially after the major heating season. As a result of this abnormally low temperature the portion of the ground near the grid will accelerate the heat flow from all directions and thus from the atmosphere above when warmer than the soil. Thus heat in excess of that calculated will be absorbed in such an area in the early autumn, in winter if sunshine is available and no snow is present, but especially in the spring and early summer. For this reason the amount of heat as determined by Fig. 9 could safely be assumed as available during the major heating season only, which for

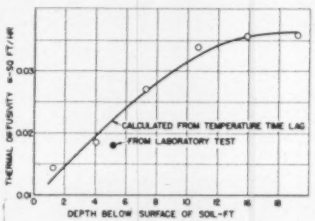


Fig. 10 — Plot of soil thermal diffusivity against depth. Calculated by means of the transient time lag of temperature change in the soil

Seattle would be from about October 15 to about March 1. For any other locality the major heating season must be determined by a study of the Weather Bureau data.

Very little heat from the interior of the earth is available since the earth's natural temperature gradient is about 1 deg increase for every 60 ft increase in depth below the point at which the temperature remains virtually constant throughout the year. Such a small differential temperature will cause very little heat migration.

Underground moisture migration, especially where the surface has a more or less gradual slope, may supply a given length of buried tubing with far more heat than would otherwise be available. Two rather unusual installations of this type have been under observation for some time in connection with these studies. However, with other heat pumps in the near vicinity, such moisture migration might become a detriment.

Determining the Operating Time

Weather Bureau records offer a rather simple means of calculating the approximate percentage of the total time the heat pump will operate each month. A properly designed heating system should supply the house with adequate heat on the average coldest day that might be expected. In most northern climates such days occur in January. This average coldest day should be chosen by selecting the coldest January day for each of a number of years taken more or less at random, such as every one for five or more years, or every other one for ten or more years. Since the heating system must run almost continuously on this day, the degree days for this average coldest day multiplied by the days of the month considered would give the equivalent monthly degree days. The Weather Bureau's average degree days for a given month, divided by this equivalent value, and then multiplied by 100 will give the percentage of time the heating system will operate during that month. Tables 3 to 6 present such computed percentages using the Weather Bureau's 50-year monthly average degree days, and seven random years to determine the average cold-

est day. In each case the actual percentage of operating time as computed for houses using heat pumps is also given. In most cases the actual operating time is less than that computed. This either indicates that the unit is larger than necessary or that heating is being conserved, as is the case when the house is not heated at night, or unoccupied temporarily. In other cases the actual operating time is greater than the computed time, which might indicate an under-sized heating unit.

The computed operating times for the various climates result in some interesting differences. Thus, the operating times in Seattle or Portland are rather high and spread throughout most of the year though the degree days per year for Spokane or Boise are both much higher than those of Seattle or Portland. This means that the unit for Seattle or Portland can be smaller than is necessary in Spokane or Boise for the same type of house. On the other hand it must operate more of the time especially in early spring or late autumn, and may even be needed occasionally during the summer months because the weather on the Coast is tempered throughout the year by the nearness of the ocean.

Possibilities of Determining Soil Constants

With continually recorded temperatures at various depths below the soil surface as were taken for this study, the transient behavior of the flow of heat can be determined. Since the rate at which the heat travels through the soil is determined by such soil constants as thermal conductivity and diffusivity, such constants can be thus calculated by using equations based upon the solution of Fourier's differential equation[1] for temperature variations with the flow of heat.

Calculations of this nature were made using the formula,

$$\alpha = x^2 P / 4\pi t^2 \quad \text{----------(2)}$$

where t is the time required for a given temperature to travel x distance either upward or downward.

The subsurface temperatures recorded at Station A were used to determine such time delays. Fig. 10 is a plot of the calculated thermal diffusivity at various depths below the surface. Laboratory tests[2] on a sample taken about 5 ft below the surface at Station A gave the value indicated on the curve as a laboratory determination.

The diffusivities determined by the use of Equation 2 appear to be a little high especially at the greater depths. However, the greater moisture content and possible increased density at such depths would account for some increase.

The temperature records were not taken with this application in view. The use of more accurate methods of recording temperatures for this purpose might have resulted in even better results.

Conclusions

This study proposes approximate methods of using Weather Bureau records, which are quite generally available, to determine some of the desirable information for the design of heat pumps and ground grids. To determine more accurately the ground heat available, the temperatures near the surface of the soil must be obtained throughout the year, and even these would give information for that year only. Needless to say, the time and cost would in general be prohibitive.

If similar comparisons could be made between the approximate methods and the more accurate ones wherever actual ground surface temperatures are available, the accumulated results would probably suggest a very acceptable procedure until enough experience with heat pump and ground-grid operation has been acquired to suggest better methods.

In general climatology data are very valuable in such heating design work.

Acknowledgments

This paper is a report on one phase of a rather extensive research program supported by grants from the Bonneville Power Administration and the University of Washington Engineering Experiment Station. The author also wishes to mention the valuable assistance of Dr. Phil E. Church, head of the Meteorology and Climatology Department at the University of Washington.

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G. E. MAY NAMED IN PROMOTION

G. E. May, founder and first president of the Delta Chapter of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, has been appointed assistant chief engineer for New Orleans Public Service, Inc., New Orleans, La.

Mr. May joined New Orleans Public Service, Inc., in 1928 after graduation from Tulane University and has been engaged in engineering for ventilating, air conditioning, and refrigeration throughout his career. In 1940, he was named chief utilization engineer, the position he held at the time of his present appointment.

Mr. May is active in local civic and professional organizations. He is a member of the *Louisiana Engineering Society*, the *Society of Illuminating Engineers*, and the *American Gas Association*. Mr. May furthermore, is active for the Boy Scouts of America. He has served as a member of the council executive board for the New Orleans area since 1944, and as a council commissioner since 1947. In 1948, he received the Scouts' Silver Beaver Award in recognition of his leadership in many scouting activities that year.

Optimum Panel Surface Distribution Determined from Human Shape Factors

By F. W. Hutchinson,* Berkeley, Calif., and
Merl Baker,** Lexington, Ky.

SUMMARY — This paper presents the results of an experimental investigation of the shape factor of the clothed human body with respect to energy emitted by floor areas. The results complement those of an earlier paper in which similar shape factors were reported for the human body (in standing and in sitting position) with respect to energy emitted by wall and ceiling areas; the present study was limited to the standing position.

Results of the more recent study are presented in Fig. 1, the two curves being for full-face and for semi-profile views and the assumption being (as proved valid by test) that shape factors for the front view can be accurately taken as equivalent to factors for the back view of the standing figure. Additional experiment on 10 subjects whose figures differed markedly from *average* showed that human shape factors for approximately 95 percent of the population will agree within plus or minus 7 percent with the data obtained from the dummy which represented an average man; for the majority of people (say 75 percent) agreement between actual and dummy shape factors will be found to be extremely close.

For engineering purposes the major value and need of human shape factors is in the determination of direct radiant transfer between a subject and a local heating or cooling panel. The data of Fig. 1 permit rapid and accurate evaluation of the shape factor of any standing subject with respect to radiant energy emitted by a floor panel of any size, shape, or position with respect to the subject. A second use of the data is in determining optimum surface distribution for space-heating (as distinct from local heating) panels in rooms where the panel area-floor area ratio is small.

Fig. 5 gives experimental results for standing subjects and will be found useful in graphically showing the effect of panel location.

EIGHT years ago, as part of a program of research sponsored by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in cooperation with the University of California, a progress report[1] was presented giving experimentally determined human shape factors for seated and standing subjects in rooms with 8, 10, 12 ft heated or cooled ceilings. The present report, submitted long after conclusion of the cooperative panel heating project, supplements the original study by presenting data for a human subject with respect to a heated or cooled floor panel.

The two major applications of human shape factors are: (1) In determining that distribution of heating or cooling surface (in a floor or ceiling that is not 100 percent heated or cooled) for which the optimum uniformity of heating or cooling effect will be experienced by the occupants. (2) In determining the size of a heating or cooling panel for producing a localized region of greater warmth or of increased cooling effect; the importance of this second application is particularly great in the solution of industrial problems such as occur in production lines or in large structures having low density of occupancy.

Theory

In any heated or cooled structure, under conditions of steady state, the only condition which can lead to variation in the feeling of warmth experienced by an occupant is change in the geometrical position of that occupant with respect to the surrounding surfaces. Thus, due either to movement from place-to-place in the room or to alteration of the geometry as by standing, sitting, or reclining, the radiant exchange between the occupant and the surroundings may be subject to variation. Maintenance of uniform warmth is a prerequisite to comfort, hence the designer must seek to minimize changes in net radiant transfer that occur due either to movement or to change in position. Analysis of such changes requires evaluation of the net transfer to-or-from the occupant.

The geometry of an occupant with respect to his surroundings is expressed in terms of a shape factor which may be defined by Equation 1,

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For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Portland, Ore., July 1951.

$$F_{os} = (1/A_s) \int_{A_o} \int_{A_s} \frac{\cos\phi_o \cos\phi_s \, dA_o \, dA_s}{\pi (r_{os})^2} \quad \text{----------(1)}$$

where,

F_{os} = shape factor of the occupant with respect to energy received from surface A_s, or fraction of energy emitted by A_s which is received by the occupant.

r_{os} = distance between center of surfaces A_o and A_s.

ϕ_o = angle between r_{os} and normal to center of A_o.

ϕ_s = angle between r_{os} and normal to center of A_s.

The emissivity of an average clothed person closely approaches unity (hence the absorptivity is likewise close to unity) so the net transfer rate, by radiation, between an occupant and any surface which he *sees* is given by Equation 2.

$$q_{os} = 0.172 (e_s)(F_{os})(A_s) \left[(T_s/100)^4 - (T_o/100)^4 \right] \quad \text{----------(2)}$$

where

q_{os} = net radiant transfer, Btu per hour from A_s to occupant.

e_s = emissivity of the surface A_s.

A_s = area of the surface which the occupant *sees*.

T_s = absolute surface temperature of A_s.

T_o = absolute surface temperature of the occupant.

Procedure

Because of the complex curves and projections of the human body it is not possible by any convenient mathematical simplification to evaluate accurately the double-integral equation which defines the shape factor of an occupant with respect to a panel. The aesthetically pleasing diversity of human shapes is responsible for insurmountable technical difficulties with respect to the rational evaluation of either individual shape factors or an average human shape factor. The investigation reported in this paper was intended to provide accurate experimentally determined shape factors for an *average* person with respect to energy emitted by areas in the floor at varying distances from the point at which the subject is standing. As a check on the applicability of *average man* factors to markedly non-average individuals the investigators were fortunate in securing the anonymously-given services of some 10 subjects who collectively represented the extremes (for 95 percent of the population) of variation in height, width, depth, position of center of gravity, and maximum of local projection of the clothed human figure in profile and in full-face view. Since the shape factors of all but one of the *boundary* subjects were within plus or minus 4 percent agreement with the shape factor of the average subject (for floor areas more than 5 ft 6 in. out from the position of the standing subject) it appears that the shape factors given here can be used with acceptable accuracy for any person whose figure is close enough to the accepted norm to permit escaping marked public attention.

The experimental procedure followed in collecting data for this paper was the same as that used in the earlier investigation[1] of human shape factors with respect to wall panels and to ceiling panels. In brief summary, the test subject was a clothed dummy representing a 5 ft 10 in. man weighing 165 lb; the dummy was dressed in a two-piece suit, remained in standing position, and had both arms at its sides. Shape factors were determined experimentally by means of a mechanical integrator of the type proposed by Hottel† and developed by Boelter†† and associates. Since the earlier tests showed that full-front shape factors agree closely with full-back factors and that front semi-profile factors differ but little from rear semi-profile shape factors the present investigation was limited to a determination of full-face and of front semi-profile values; the data for these two positions can then be readily interpolated and extrapolated to permit development of a complete *field* for each of the four identical quadrants which make up the floor region within an 18 ft radius of the subject.

Since the exchange rate, for a fixed position of the occupant, is the sum of the exchange rates for all unit areas of the panel, the problem resolves itself into a determination of the exchange variation between a fixed unit area (or infinitesimal area) of panel and a moving occupant. More simply, the experimental data can be collected for a system in which the occupant retains a fixed position and the element of panel is moved.

As used in this research the mechanical integrator was placed directly over the point selected to represent the center of the elementary panel area. From this position a beam of light from the integrator was directed around the outline of the subject. For each such determination the integrator drew a closed curve on a piece of paper; the area within the curve was determined with a planimeter and divided by an instrument constant to obtain the shape factor of the subject with respect to energy emission from the point source located at the center of the elementary panel area. Shape factors were obtained at 1-ft intervals from the dummy to a maximum distance of 18 ft. Re-determinations were made at each point at least three times and never less than the number of times required to assure reproducibility of results.

New Experimental Results

Floor Panels. Fig. 1 presents the two basic curves which summarize the new experimental data. The abscissa can be considered as representing either the distance from a fixed subject to various elements of floor area or the distance from a fixed element of floor area to a subject who is moving around in the room. The ordinate is numerically equal to the fraction of energy emitted by a diffuse floor surface which will be intercepted by the standing subject; the shape factor assists in determining irradiation of the subject, but not energy reception, since the latter depends on the absorptivity of the receiving surface. With very few exceptions the materials ordinarily used for clothing have emissivities substantially greater than 90 percent, hence, for practical engineering calculations it is usually

[1]Exponent numerals refer to Bibliography.

†Radiant Heat Transmission, by H. C. Hottel, (*Mechanical Engineering*, Vol. 52, 1930).

††A Mechanical Integrator for the Determination of the Illumination from Diffuse Surface Sources, by V. H. Cherry, D. D. Davis, L. M. K. Boelter, *IES Transactions*, 1939).

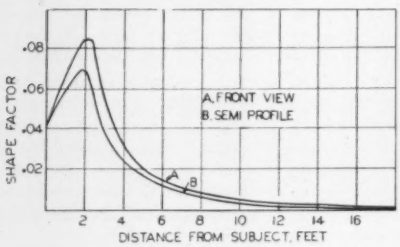

Fig. 1 — Fraction of energy reaching a standing subject from an elemental panel area

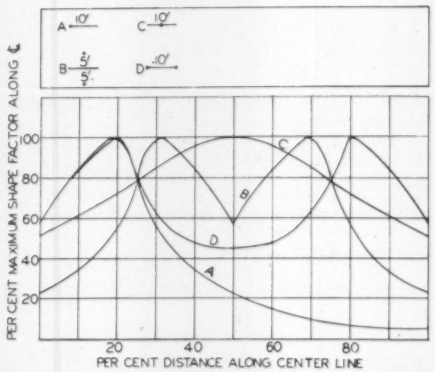

Fig. 2 — Comparison of shape factor variations for the panel arrangements shown

sufficiently accurate to assume that all long-wave length irradiation is absorbed by the subject.

Examination of Fig. 1 shows that maximum irradiation occurs from areas 2 ft out from the subject and that beyond this distance there is a very rapid falling off of the shape factor. Five feet out from the subject the fraction of energy leaving the floor which strikes the occupant is under 2 percent and 7 ft out, this fraction has decreased to less than 1 percent. Beyond 10 ft less than one-half of 1 percent of the energy emitted by a warm floor will provide irradiation of the occupant. For an occupant remaining in a fixed position—as in some kinds of factory work—it is evident that maximum effectiveness of local heating (or cooling) would be attained by providing a heated *ring* of floor surface having an inside diameter of approximately 3 ft 6 in. and an outside diameter of 4 ft 6 in.; the average direct radiant transfer from this ring to the occupant would be of the order of 7 percent hence, per unit area, the ring would be some 700 to 1000 percent more effective than uniform heating of the entire floor area.

Application of Floor Data

The data of Fig. 1 can be used directly to determine the shape factor of any floor panel of any size or shape with respect to a standing subject in any position, either on or off of the panel. The procedure is to divide the panel into equal areas (preferably not larger than 2 by 2 ft on the sides) and determine the distance in feet from the subject to the center of each such area; then reference to Fig. 1 will give the shape factor of the subject with respect to energy received from each of the areas and the *average* of the individual area shape factors will be equal to the shape factor of the subject with respect to energy received from the entire panel. By the same method the variation in energy reception from a given panel as a function of the position of the occupant can be readily investigated.

A knowledge of human shape factors is necessary in the design of local radiant systems for either heating or cooling, and in the determination of optimum distribution of heated or cooled surface in a room for which the total load is insufficient to justify 100 percent coverage. The first of these problems requires special study for each individual application and the procedure is identical with that described in the preceding paragraph. The second problem more readily lends itself to generalized solution hence will be given more detailed consideration in the following section.

Optimum Surface Distribution

Floor Panels. In any panel heated or cooled enclosure the designer must establish environmental conditions such that uniform warmth will be experienced by the occupant irrespective of his position in the room. This condition requires minimum variation in the direct transfer of radiant energy between the occupant and the primary heating or cooling surface. Referring to Fig. 2, Curve A shows the percentage of maximum shape factor that would exist as an occupant moved backward or forward along a line 10 ft out from a small element of primary area; when 7 ft out from the area the irradiation rate would be 10 percent of that corresponding to a distance of 2 ft out.

Curve B of Fig. 2 shows variation over the same 10 ft line, but with small primary areas located 5 ft out from the center of the line on either side; in this case substantial improvement in uniformity over the conditions of case A has been achieved. Curve C is for the unit area located at the center of the 10 ft line and again shows improvement over the arrangements of Curves A and B. Curve D, for unit areas at each end of the line, is practically equivalent to Curve C as far as maximum variation goes, but is less effective because of the rapid change in shape factor at a distance 2 ft in from each end of the line.

Fig. 3 provides an extension of the condition shown by Curve D of Fig. 2 (which curve is reproduced, for purposes of comparison as Curve D of Fig. 3). Curves A, B, and C of Fig. 3 are for line panels of 4, 20, and 40 ft, respectively, centered at either end of the 10 ft line and normal to it. Reference to these three curves will show that both the center and end *droops* of the shape factor variation decrease with increasing length of the line panel. For lengths

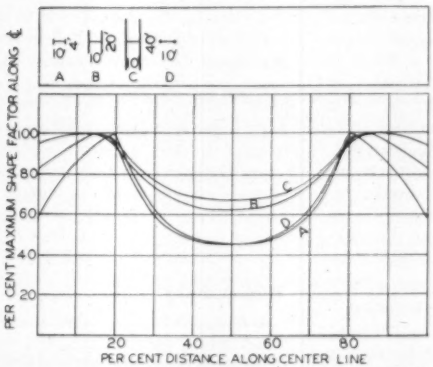

Fig. 3 — Comparison of shape factor variations for the panel arrangements shown

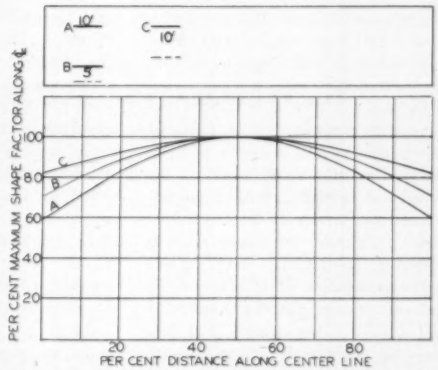

Fig. 4 — Comparison of shape factor variations for the panel arrangements shown

beyond 20 ft, however, the influence of panel length on droop is very much reduced.

Fig. 4 shows the variation for the case of a line panel parallel with the path of the occupant and either superimposed on it (Curve A) or a distance of 5 ft out (Curve B) or 10 ft out (Curve C). Once again it is immediately evident that uniformity of direct radiant transfer increases as the panel moves farther away from the subject. Although Fig. 4 does not show curves for panel distances greater than 10 ft out, a simple analysis by the method already described will demonstrate that there is relatively small improvement in uniformity for panel distances appreciably greater than 10 ft.

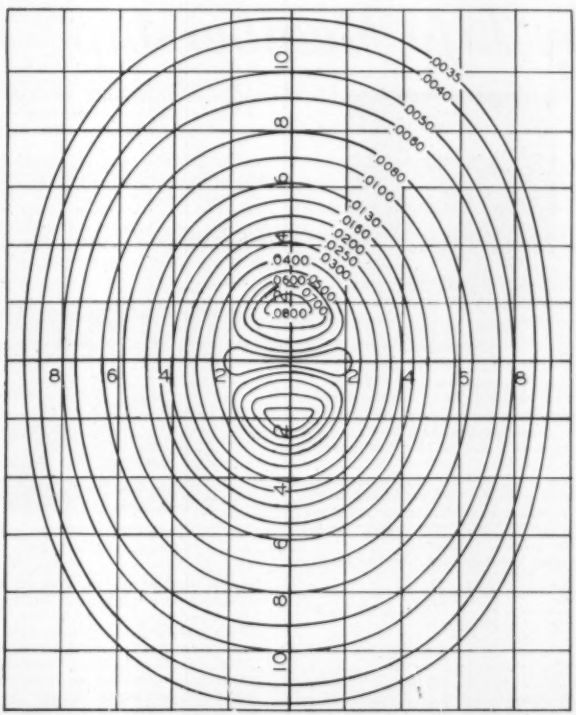

Fig. 5 — Floor panel for standing subject

Comparing Curves B of Fig. 3 and B of Fig. 4, it is noted that these two types of panel distribution complement one another. From this fact it appears that an excellent degree of uniformity of primary radiant exchange would be attained in a room 10 by 10 ft if the heated section of the floor were limited to a band running around the periphery of the room. For a room 20 by 20 ft excellent distribution would be achieved by a peripheral panel combined with two center line cross-panels which would make the distribution equivalent to that in four adjacent 10 by 10 ft rooms. The present analysis does not provide sufficient data to warrant the conclusion that 10 ft spacing of the strip panels is optimum, but the reader can readily verify that 10 ft is more effective than any lesser spacing and is but little less effective than any greater spacing.

For the great majority of rooms that are heated or cooled by means of floor panels the required ratio of panel surface to total floor surface is so great that no attempt can be made to achieve uniformity of direct transfer by selective distribu-

tion of panel surface. The possibility does exist, however, of improving distribution in such cases by designing for a higher surface temperature in the 2- or 3-ft wide peripheral section; with sinuous coil or grid-coil panels this can be done by spacing the pipe or tube more closely in the peripheral section. Aside from increased uniformity of direct transfer such peripheral emphasis is also desirable, particularly near outside walls. as a means of offsetting cold-wall effect and thereby improving uniformity of the overall heat balance (as contrasted with uniformity of direct primary transfer).

Integration of All Experimental Results

Fig. 5, obtained by interpolation and extrapolation of the data from Fig. 1, visualizes the occupant as standing at the center of coordinates and facing in the positive direction of the y-axis. Each curved line of the figure represents a locus of points on the floor around the occupant for which the shape factor has constant value; such iso-shape factor lines permit direct visualization of the fraction of energy emitted by any point on the floor and striking the occupant. Thus from a point on the floor 2 ft to the right and 2 ft ahead of the occupant 4 percent of the emitted energy would be received by the occupant; the remaining 96 percent of emitted energy would miss the occupant and be received by interior surfaces of the room. Although values of the shape factor shown on the figure are specifically determined for point sources they are nonetheless applicable to any finite area of panel over which the average shape factor approaches with adequate engineering accuracy the value of the shape factor at the center of that area. To determine the shape factor of occupant with respect to any large area (as a floor panel) the panel can be sketched on Fig. 5 in its proper position with respect to the occupant and the overall shape factor then determined as the average (*not* the sum) of shape factors of selected unit areas of the large panel.

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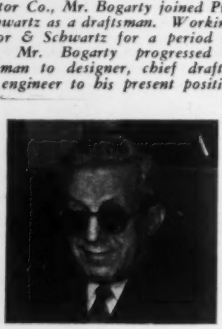
2. Experimental Evaluation of Human Shape Factors with Respect to Floor Areas, by F. W. Hutchinson (*ASME Transactions*, August, 1950).

3. Panel Heating and Cooling Analysis, by B. F. Raber and F. W. Hutchinson (John Wiley & Sons, Inc., New York, 1947).

Honored by Life Membership

HERMANN S. BOGARTY, Philadelphia, Pa.—Designing engineer with Proctor & Schwartz of Philadelphia. Born on January 1, 1886 in Warsaw, Poland, he attended a university in Germany.

After a brief association with the Otis Elevator Co., Mr. Bogarty joined Proctor & Schwartz as a draftsman. Working for Proctor & Schwartz for a period of 40 years, Mr. Bogarty progressed from draftsman to designer, chief draftsman, chief engineer to his present position of



Hermann S. Bogarty
Philadelphia, Pa.

design engineer. Although his work is conducted in many fields, such as soap and textile, he is most often associated with the design of tobacco drying machinery.

JOHN M. FRANK, Chicago, Ill.—President of Ilg Electric Ventilating Co. of

John M. Frank
Chicago, Ill.

Chicago. He was born on February 13, 1886 in Natchez, Miss., attended Phillips Exeter Academy and graduated in 1907 from Massachusetts Institute of Technology with a B.S. in electrical engineering.

From 1907 to 1910 Mr. Frank was associated with the Commonwealth Edison Co. of Chicago, in its testing and power departments. Mr. Frank joined the staff of Ilg Electric Ventilating Co. in 1910, becoming president of the company in 1928.

He joined the Society in 1912 and has been active both in Society activities and local chapter affairs.

DWIGHT E. HUMPHREY, Cuyahoga Falls, Ohio.—Owner of a sales and engineering business under his own name. Born on February 29, 1884 in Summit County, Ohio, he attended Lewis and Ohio State Universities, where he took up courses in mechanical, ceramic, and mining engineering.

After finishing his education, he joined the Medal Brick Co. of Cleveland and became general superintendent. He was secretary and manager of the Portage Engineering Co., Akron, Ohio for a period of two years and then joined the United Furnace Co., where his work was in the field of power house and blast

Dwight E. Humphrey
Cuyahoga Falls, Ohio

furnace engineering. In 1918 he became a heating and ventilating engineer for The Goodyear Tire & Rubber Co. at Akron, where he remained until 1949 when he left to form his own business.

Mr. Humphrey is a registered engineer in the State of Ohio, and a member of the American Ceramic Society. A member of the Society since 1921, he served on the TAC on Industrial Ventilation in 1948.

Heat Requirements of Buildings

By C. W. Signor,* Detroit, Mich.

SUMMARY—This paper is a record of the heating and process steam requirements for 24 different types of buildings supplied by steam from a district heating system. These requirements are tabulated as pounds of steam used per unit of radiator surface and heated space in the building.

THE PURPOSE of this paper is to make available a tabulation of the heating and process steam requirements of 544 buildings located in the business center of Detroit, Mich. These buildings are grouped into 24 classifications according to their usage and size and are supplied with steam from the underground district steam distribution system. The maximum steam pressure delivered to the user is 28 to 32 psig with the exception of a 100 psig main serving the high pressure requirements of two hospitals. The steam enters the buildings through a service pipe and then the pressure is reduced as required for heating and process.

*Supervisor of Customers' Steam Service, The Detroit Edison Co. Member of ASHVE.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Portland, Ore., July, 1951.

Steam Metering

All condensate from the heating and process equipment in a building is returned to a central point, where possible, and it then goes to a condensate meter. The amount of steam used in sterilizers, cookers, clothes presses, etc., and which cannot be metered is relatively small and is not included in the figures in this paper. In such buildings as hospitals and hotels, where considerable open end steam is used, this steam is metered by a flow meter.

Buildings and Equipment

The buildings are located in or near the downtown business district of Detroit. These buildings vary in type in this area from some of the older to some of the most modern.

In nearly all of the heating systems, steam is used in the radiators, but in a few cases steam is used by means of a converter to supply hot water for space heating. The steam heating systems vary from the old one-pipe gravity heating system to a modern two-pipe high vacuum, zoned heating system.

In some of the buildings, heating is still controlled by manual operation of gate valves. In the remainder many types of building temperature controls are used, including unit thermostats, outdoor actuated cycling controls, outdoor actuated program controls, and the medium and high vacuum controls. Buildings have one or more controls depending upon the number of zones.

Table 2—Steam Condensed Per Square Foot of Radiator Heating Surface*

Year	Avg. Temp. Heating Season, F	Lb/Sq Ft Radiator Surface	Lb/Sq Ft Radiator Surface/Deg Below 65 F
1921	42.5	473	21.1
1922	40.8	470	19.4
1923	37.8	484	17.8
1924	38.6	484	18.4
1925	38.2	467	17.5
1926	36.1	493	17.1
1927	39.2	418	16.3
1928	39.9	436	17.4
1929	40.4	436	17.7
1930	39.4	366	14.3
1931	40.7	303	12.5
1932	43.2	308	14.2
1933	40.4	295	12.0
1934	37.2	315	11.4
1935	38.4	316	11.9
1936	37.4	372	13.5
1937	38.8	329	12.6
1938	40.0	290	12.4
1939	40.2	307	12.3
1940	37.2	338	12.0
1941	39.9	294	11.7
1942	41.7	318	13.7
1943	37.8	358	13.2
1944	39.1	332	12.8
1945	39.5	353	13.8
1946	40.3	323	13.1
1947	39.4	362	14.2
1948	39.0	360	13.8
1949	41.6	328	14.0

*Based on the average of total connected radiator heating surface at the beginning and ending of each year.

Steam Consumption Records

There were 1786 customers being served by the distribution system during the heating season of 1948-49. For each building with more than 750 sq ft of radiator surface, a *Steam Consumption Record* card such as shown in Table 1 was prepared. Each month the amount of steam used by each building and the cost is entered on the card.

The *Estimated Monthly Consumption for Process, Lb*, as shown on

Table 1—Steam Consumption Record

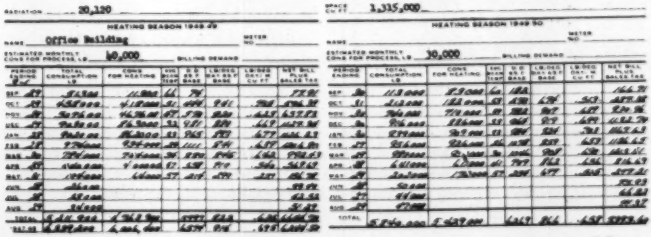


Table 3—Heating and Process Steam Requirements of Buildings

Classification	Number of Buildings	Total Consumption		Heating Consumption		Degree Days	Heating Only	Process Only
		Lb Steam/Sq Ft of Rad. Sur./Yr	Lb Steam/Cu Ft of Heated Space/Yr	Lb Steam/Sq Ft of Rad. Sur./Yr	Lb Steam/Cu Ft of Heated Space/Yr		Lb Steam/DD /M Cu Ft of Heated Space	Lb Steam/Cu Ft of Heated Space/Yr
Apartments	25	584.6	9.50	412.3	6.70	5797	1.15	2.79
Apartment Hotels	4	394.2	9.11	261.0	6.03	5797	1.04	3.07
Banks	16	208.4	4.43	178.5	3.80	5797	0.656	0.655
Bowling Alleys and Sports	7	188.6	3.85	176.2	3.59	5797	0.620	0.252
Churches	17	190.1	3.35	177.5	3.13	5797	0.541	0.222
Clubs	16	343.1	7.89	214.0	4.92	5797	0.850	2.97
County, Federal and State Building	24	239.7	4.33	214.2	3.86	5797	0.667	0.464
Garages[a]	10	307.1	3.12	286.2	2.90	4250	0.684	0.211
Hospitals	6	756.9	12.44	392.3	6.62	5797	1.142	6.20
Hotels — Small[b]	34	586.6	9.66	406.8	6.64	5797	1.15	2.95
Hotels — Large[c]	17	668.7	10.30	384.5	5.92	5797	1.02	4.37
Manufacturing Concerns	53	356.0	5.61	317.0	4.99	5797	0.859	0.613
Miscellaneous	2	156.9	3.65	129.5	3.01	5797	0.520	0.633
Newspaper & Printing Est.	22	427.0	7.71	362.6	6.52	5797	1.12	1.15
Office Bldg — Small[d]	78	321.3	5.41	284.4	4.79	5797	0.825	0.625
Office Bldg — Medium[e]	20	307.4	5.06	250.4	4.12	5797	0.714	0.940
Office Bldg — Large[f]	20	259.1	4.43	211.8	3.61	5797	0.623	0.808
Restaurants	49	291.2	14.57	116.4	5.81	5797	1.00	8.75
Sales and Service	15	302.9	4.90	268.1	4.34	5797	0.750	0.561
Schools	8	123.8	4.76	110.5	4.25	5797	0.734	0.509
Theatres	24	139.9	2.91	132.6	2.76	5797	0.477	0.152
Stores — Retail	87	220.3	3.94	147.8	2.64	5797	0.456	1.29
Stores — Wholesale	15	300.5	4.35	275.7	3.99	5797	0.690	0.358
Warehouses	10	324.2	3.52	308.9	3.35	5797	0.579	0.174

[a]A degree basis of 65 F was used for all buildings except garages which are based on 55 F basis
[b]Hotels under 1,000,000 cu ft of heated space
[c]Hotels over 1,000,000 cu ft of heated space
[d]Office buildings under 1,000,000 cu ft of heated space
[e]Office buildings between 1,000,000 and 2,000,000 cu ft of heated space
[f]Office buildings over 2,000,000 cu ft of heated space

the card, is metered in a few buildings, but for most of the buildings is represents the average monthly steam consumption during the summer months when building heating is not required. *Process* includes water heating, cooking, etc.

Consumption for Heating is the difference between the total consumption and the process load.

Average Mean Temperature and the *Degree Days, 65 F base* are from the data of the United States Weather Bureau located at the Detroit City Airport.

Lb per Degree Day and the *Lb per Degree per M cubic feet of Space* are computed and entered each heating month when heating is required.

The cubic feet of space for each building, as is shown at the top of the card (Table 1) is not the architectural cubage but is the heated space from inside measurements of the building.

Purpose of Steam Consumption Record

The purpose of keeping steam consumption records for these buildings is to obtain an indication whether the use of steam is above or below the normal requirements of the building and whether the use is above or below normal for the type of building or business.

When the steam use in a building is below normal, it is usually due to a reduction in: space heated, hours of heating, or inside temperature, or it may be due to loss of condensate before metering. When the steam consumption is above normal it is usually due to increased space heated, increased hours of heating, careless operation of equipment, or faulty equipment.

The building owner or engineer is notified of abnormal use of steam and advised how waste can be eliminated. This requires a continuous educational program in which users are informed about the best and most economical ways of using steam service.

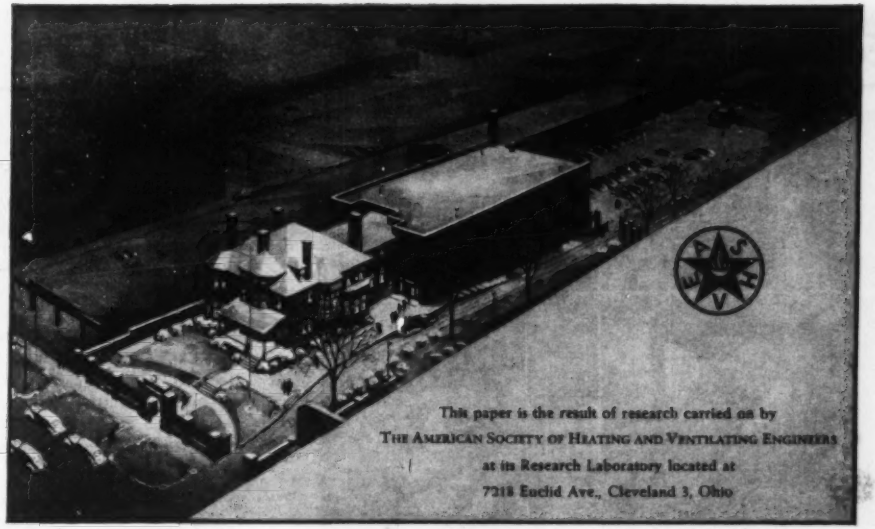
The results of work with users is illustrated in Table 2 which is based on the total pounds of steam consumed by all users during a year, the average connected radiator surface and the average temperature for each heating season. The last column, Pound Per Square Foot of Radiator Surface Per Degree below 65 F shows considerable decrease between 1921 and 1931. In the years from 1932 to the present this figure has fluctuated somewhat due to various factors such as economic conditions and growth of system.

Heating and Process Steam Requirements of Various Buildings

The period covered by this study was the 12 months ending August 30, 1949. The steam consumption records for buildings having more than 2000 sq ft of radiator surface were classified into 24 different groups as shown in the left hand column of Table 3. The steam consumption for the buildings in each group has been calculated on the basis of radiator surface and heated space. Steam for heating has been given in pounds per degree-day per thousand cubic foot of heated space. Steam for process is given in pounds per cubic foot of heated space per year.

IPHA HAS ANNUAL MEETING

The *Illinois Public Health Association* held its eleventh annual meeting jointly with the *Middle States Public Health Association* at the Congress Hotel in Chicago, April 18, 19, and 20. The conference was highlighted by speeches by noted health authorities.


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Barometric Draft-Control Analysis

By H. B. Nottage*, D. W. Locklin** and R. G. Huebscher†, Cleveland, Ohio

SUMMARY—Initial results are reported for a research program concerning the physical fundamentals of barometric draft-control performance. Illustrative data demonstrate an analytical approach toward predicting damper positions and flow rates in relation to damper draft. The principles demonstrated should be useful in design studies.

DRAFT control is an important subject relating to: (1) fuel economy, (2) safety, (3) comfort from even heating rates, and (4) design of appliances and chimneys.

The Research Technical Advisory Committee on Combustion has recommended the barometric draft control as needing research study. A survey of the practical aspects of design and performance[1] led to a program being outlined with the objectives: (1) to determine representative basic data needed to improve barometric draft-control design and performance, (2) to aid effective designs and installations by an exposition of physical principles, and (3) to work toward possible standards of value to the industries concerned.

Program

The initial steps reported here comprise: (1) *damper mechanics*, and (2) *damper through-flow characteristics*. Further work is not presently contemplated.

Definition

A barometric draft control is defined as an automatic, adjustable, or factory-set, self-contained, draft-actuated device the purpose of which is: (1) to prevent excessive draft on a fuel-burning appliance, and (2) to make the appliance draft nearly independent of chimney draft over the normal range of operation. This device is to embody moving parts which operate by opening a by-pass from the surroundings into the flue pipe, or by restricting the flow in the flue pipe, or both, in accord with the magnitude of the appliance draft.

The barometric draft control is generally applied to coal or oil burn-

Research Program Outlined by Technical Advisory Committee on Combustion

1. *Damper Mechanics*: (a) Construction features and types. (b) Relation between applied torque and angular position of the rotating damper assembly. (c) Design possibilities.

2. *Damper Through-Flow Studies*: (a) Relation between damper flow rate, damper position, and draft across damper for duct-end mounting. (b) Relation between damper position and torque resulting from damper draft and air-flow pattern through opening.

3. *Damper Tee-Flow Studies*: (a) Extension of the preceding step to tee mountings. (b) Use of heated air simulating appliance exhaust.

4. *Performance Tests and Analyses of Barometric Draft Controls as Constituents of a Complete Draft System*: (a) Basic physical data and their practical interpretation. (b) Critical analyses of possibilities and limitations in complete-system performance.

5. *Consideration of Practical Aspects in Selection, Installation and Operation of Barometric Draft Controls.*

6. *Possible Standards in Cooperation With the Industries Concerned*: (a) Test methods and codes. (b) Evaluation in public interest.

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[1]Exponent numerals refer to References.
For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Portland, Ore., July 1951.

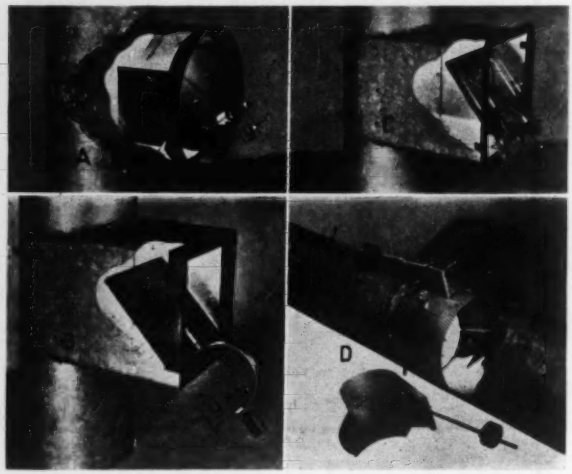


Fig. 1—Barometric draft controls studied

ing installations and is not to be confused with draft hoods used in gas installations. (Instances also are known where these controls have been employed in ventilation systems.)

Scope of Investigation

Performance rating or selection of a barometric draft control requires either: (1) an actual test of whatever complete draft system is involved, or (2) availability of proper fundamental data of such a nature that a trustworthy performance prediction may be made. The program outlined is dedicated to the second alternative, which calls for the synthesis of system performance from component-element data.

To obtain exemplifying data on physical principles, four types of barometric draft controls were selected; these are illustrated in Fig. 1 and described in Table 1. Only units in an unused condition were studied. Effects of service deterioration were beyond the scope of the first part of the program. Furthermore, only static or equilibrium behavior was investigated; problems of dynamic behavior were left untouched.

Fig. 2 introduces and orients the constituent aspects of the present studies. Each topic is subject to planned design control with the aid of a few careful experiments.

Damper Mechanics

Referring to Fig. 2, damper mechanics comprises analysis of design details, the actuating forces producing damper motion, and whatever positioning characteristics may be desired.

An installed barometric draft control positions itself through force action and thereby produces flow regulation. The damper position is the common factor in tying damper mechanics to flow phenomena.

Rotation results from torque action. As long as the rotating damper assembly operates as a rigid body, the torque required to balance the assembly at any angular displacement from free rest is defined, following Fig. 3, as

$$L = Wr \sin \phi \qquad (1)$$

where

L = balancing torque, pound-inches
W = weight of all rotating parts, pounds
r = distance between center of gravity and axis of rotation, inches
ϕ = angular displacement from free rest

The center-of-gravity location is of outstanding operating importance. A fully-closed damper generally is not in the free-rest position. Establishing the center of gravity,

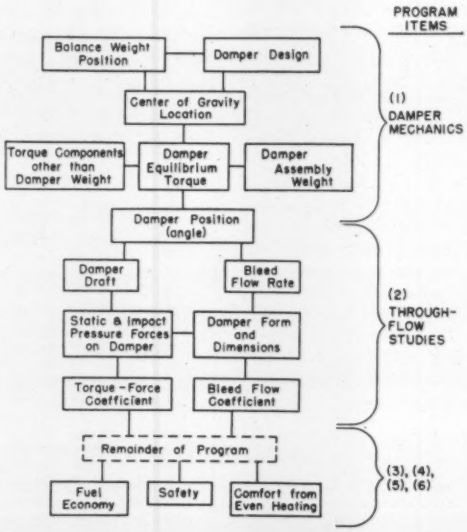


Fig. 2—Inter-relationships studied

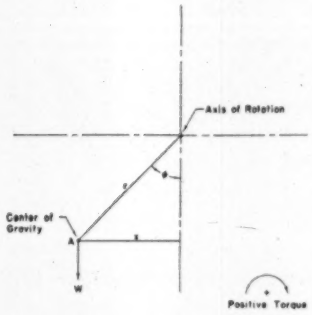


Fig. 3—Damper-weight torque about axis

therefore, requires either: (1) tests, or (2) a design analysis from a drafting-table layout. The first of these approaches was followed in the present instance and results are contained in Appendix A.

A review of Fig. 4 yields practical interpretations of center-of-gravity behavior for a rigid rotating assembly:

1. In a position of free rest (*i.e.*, no external torque) the center of gravity will be at point A_1, vertically below the axis.

2. The torque will be a maximum at a rotation of ninety degrees from A_1 to A_2.

3. For any center-of-gravity position in quadrants III or IV, as A_3, the torque equilibrium is inherently stable.

4. For any center-of-gravity position in quadrants I or II, as A_4, the torque equilibrium may easily be unstable.

Torque Data

Balancing-torque data were obtained by applying a known external torque to each damper with the aid of an apparatus which permitted either the damper frame, the damper blade, or both, to assume any rotational position. (These tests were made mechanically with the damper frame mounted separate from any duct attachment.) Determinations are summarized in Figs. 5, 6, 7 and 8. The solid lines in each instance are sine curves drawn to give the best fit for the test points, except for Fig. 7, Damper C, where a sine curve would not apply because of the torque contributed

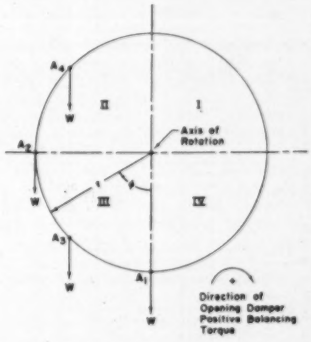
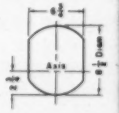
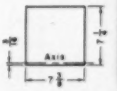
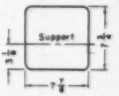
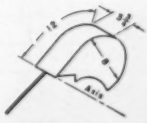


Fig. 4—Quadrant notation for center-of-gravity location

Table 1—Features of Barometric Draft-Control Dampers Tested

(All dampers were for 8-in. nominal duct size.)

Draft Control	Weight All Rotating Parts, lb	Weight of Balance Weight, lb	Nature of Rotation Axis Support	Balance Weight Adjustment	Flow Path Features	Damper Face Dimensions, inches
A	1.52	0.166	Damper fixed to axis which rolls along horizontal track.	Along threaded bolt at angle to damper face, with fixed counterweight behind damper.	Air admitted both above and below axis of rotation. Side guide vanes and turned-back damper edges employed.	
B	1.29	0.419	Damper rotates on pins attached to frame close to bottom edge.	Along slide arm suspended below and normal to the damper face.	Air passes around upper and side edges of inclined damper into rectangular duct section.	
C	0.404	0.083	Damper supported by thin sheet springs which bend along sector arm during rotation.	Along threaded bolt set normal to damper face.	Air admitted both above and below axis of rotation. Damper edges are sharp.	
D	2.01	0.69	Damper rotates on pins attached to frame.	Along threaded balance rod, extending out on opposite side of axis of rotation from damper itself.	Combines partial throttling of through-run (appliance exhaust) flow with admission of some air from surroundings through clearance space between damper and housing.	

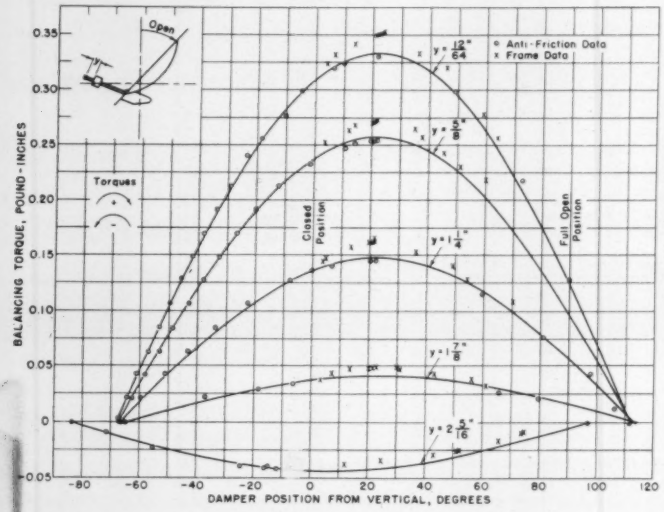


Fig. 5—Torque-position data for Damper A

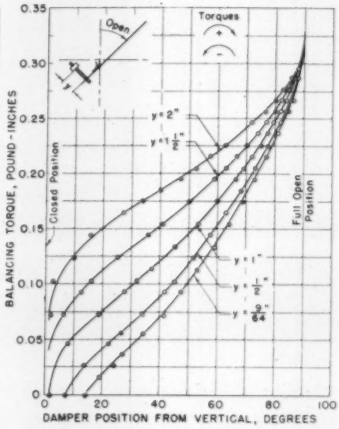


Fig. 7—Torque-position data for Damper C

by the spring supports. The dashed curves in Fig. 6 are interpolations.

In an actual draft-system installation, a pressure difference across the damper produces a torque. The damper moves until the pressure-caused torque (herein called the *balancing torque*) comes into balance with the restoring torque which arises from the weight of the rotating assembly, plus the action of springs or similar external attachments. Torque equilibrium requires that the balancing and restoring torques have the same magnitude, but opposite directions.

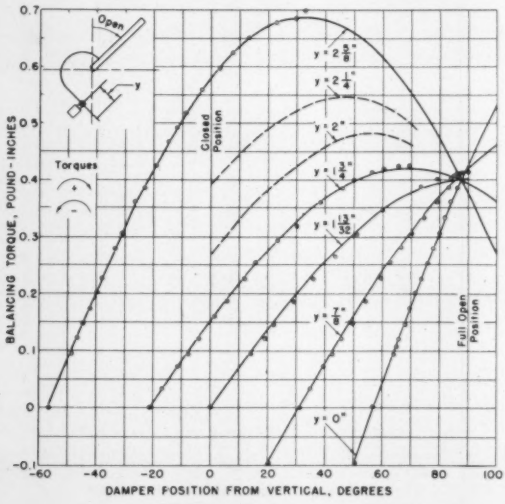


Fig. 6—Torque-position data for Damper B

Referring back to Fig. 4 for the free-swinging dampers, the points of zero and of maximum balancing torque represent, respectively, locations A_1 and A_2 for the center of gravity when they are separated by 90 angular degrees in a sequence of torque increasing with angle. One hundred and eighty angular degrees from free rest is also a position of zero torque, but here the equilibrium is unstable except for aid from possible frictional restraint.

Every effort was made to eliminate friction from the data reported. A special friction study in the case of Damper A gave the comparison shown in Fig. 5. The *anti-friction* points were obtained with the damper axis rolling on drill-rod supports, whereas the *frame* data were taken with the regular sheet-metal supports. General magnitudes of the friction torques are summarized in Table 2.

Table 2—Approximate Support-Friction Torques for the Test Dampers *(Applicable to the middle range of the torque curve)*

Damper	Frictional Torque percent of balancing torque
A*	1 to 5
B	1 to 2
C	nil
D	2 to 3

*On sheet-metal track

Pertinent interpretations for the individual cases follow.

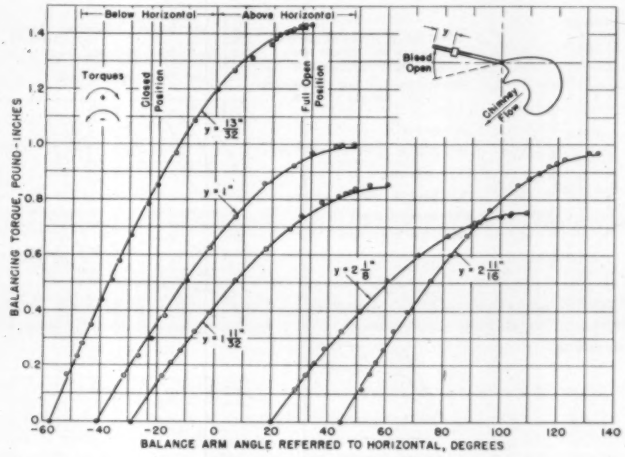


Fig. 8—Torque-position data for Damper D

Fig. 5, Damper A: The similar curves for the same free-rest positions indicate a balance-weight adjustment causing the center of gravity to move along a line passing through the axis of rotation. In this condition, one balance-weight setting would give zero torque for all positions, which would be a case of neutral equilibrium except for friction's restraint.

Fig. 6, Damper B: The joining of all curves in essentially a single point at the full-open position is a consequence of the balance weight being adjusted along a rod suspended below the damper and perpendicular to its face.

Fig. 7, Damper C: The combination of a spring torque with the weight-displacement torque is one means of obtaining a departure from the sine-curve form.

Fig. 8, Damper D: These curves are sine curves with maxima outside the range of normal operation. (The curves, as drawn, refer to the damper mounted in the position sketched. The damper also can be operated if turned upside down with the balance weight range shifted to correspond.)

Stability

The equilibrium between the balancing and the weight torques will be stable when the center of gravity is in quadrants III or IV. A change in the balancing torque will merely cause a shift to a new balance position.

When the center of gravity is in quadrants I or II, the equilibrium may be unstable. Imagine, for example, the damper at rest in some location such as A_4 in Fig. 4 and consider the two cases:

1. The balancing torque is decreased by a small amount and held constant at a new value. The weight torque then will exceed the balancing torque, and the center of gravity will fall spontaneously until a new equilibrium is reached in quadrant III.

2. The balancing torque is increased by a small amount and held constant at a new value. The weight torque then will be less than the balancing torque and the damper will swing farther open until it strikes a limiting stop or until the center of gravity finds a new balance in quadrants III or IV.

Design may prevent unstable performance. In some instances, air flow effects may reduce tendencies toward instability, although this has not been examined in the studies thus far.

Design Possibilities

From an appraisal of existing designs, it appears that full advantage has not been taken of an analytical approach to the principles of damper mechanics. Further discussion is given in Appendix A.

Damper Through-Flow Characteristics

This phase of the program considers the practical analysis of: (1) the rate of air flow through a damper opening, and (2) the torque exerted on a damper by the pressure difference across it and the flow passing through it. Referring to Fig. 2, these studies culminate in data on two coefficients, one applying to the

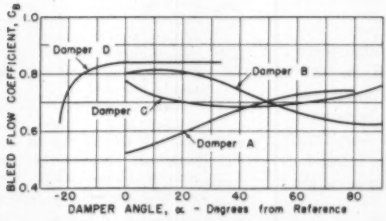


Fig. 9—Bleed flow coefficients

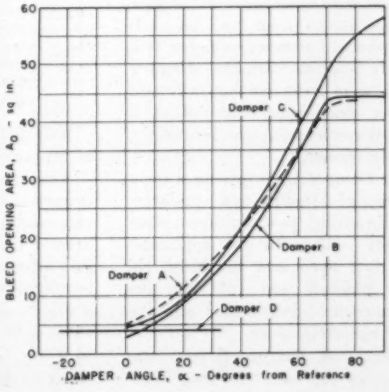


Fig. 10—Bleed opening areas

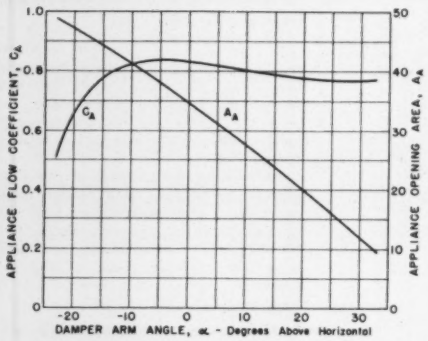


Fig. 11—Characteristics of appliance flow throttling for Damper D

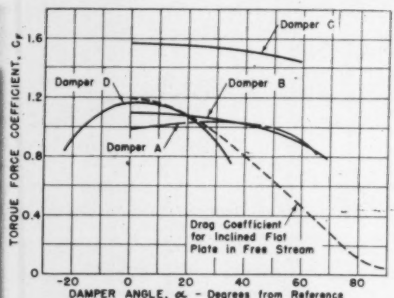

TORQUE FORCE COEFFICIENT, C_F
Damper C
Damper D
Damper B
Damper A
Drag Coefficient for Inclined Flat Plate in Free Stream
DAMPER ANGLE, α - Degrees from Reference

Fig. 12—Torque-force coefficients

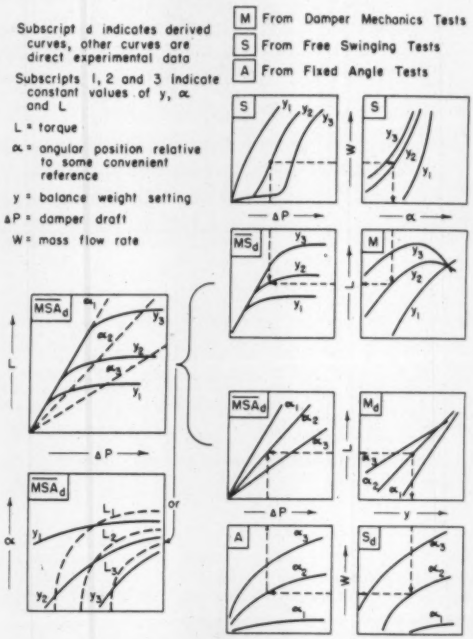

Subscript d indicates derived curves, other curves are direct experimental data
Subscripts 1, 2 and 3 indicate constant values of y, α and L
L = torque
α = angular position relative to some convenient reference
y = balance weight setting
ΔP = damper draft
W = mass flow rate
M From Damper Mechanics Tests
S From Free Swinging Tests
A From Fixed Angle Tests
or

Fig. 13—Schematic representation of the inter-relationships of performance variables

rate of flow and one to the actuating forces. Damper positions and flow rates, in turn, may be predicted from these coefficients in combination with torque-position analyses.

Coefficient Data

Dampers were mounted on the open end of a straight duct and two types of tests were run: (1) damper angle fixed and air flow rate variable, and (2) damper swinging free and air flow rate variable. Damper angles were measured optically and damper draft was measured at a static pressure tap close behind the damper frame.

For Damper D, involving a combination of bleeding and appliance-flow throttling, two test series were needed: (1) with the appliance-flow duct open and the bleed entirely blocked, and (2) with the appliance-flow duct sealed and the bleed operating alone.

The *bleed flow coefficient*, employed to represent the flow characteristics of a damper bleed opening, is defined as:

$$C_B = \frac{28.8W}{A_o\sqrt{\Delta P_D \rho/\rho_o}} \qquad (2)$$

where

C_B = bleed flow coefficient, dimensionless.
W = flow rate, pounds per second.
A_o = bleed opening area, square inches.
ΔP_D = damper draft, inches of water.
ρ/ρ_o = ratio of intake air density to standard density, dimensionless, where ρ_o is 0.075 pounds per cubic foot.

With intake from the room, there is no velocity-of-approach factor.

Area A_o was taken (by graphical determination) as the minimum cross-sectional area open for flow around the damper. The relationship between A_o and damper angle is controllable by design.

Fig. 9 shows magnitudes of C_B; these were found to be independent of W for $(\Delta P_D\ \rho/\rho_o)$ from 0.005 in. water to the upper test limit of 0.15 in. water. Fig. 10 shows corresponding A_o magnitudes. The reference damper angle here is the same as for the torque data.

For Damper D, tests with the bleed sealed disclosed an *appliance-flow coefficient* defined as:

$$C_A = \frac{28.8W}{A_A\sqrt{\Delta P_B \rho/\rho_o}}\sqrt{1-(A_A/A_D)^2} \qquad (3)$$

where

C_A = appliance flow coefficient, dimensionless.
A_A = appliance flow opening area at damper, square inches.
A_D = cross-section area of appliance duct approaching the damper, square inches.
ΔP_B = pressure difference across the damper blade, inches of water.
ρ/ρ_o = ratio of air density in duct approaching damper to standard density, dimensionless, where ρ_o = 0.075 pounds per cubic foot.

Equation 3 contains a velocity-of-approach factor. Fig. 11 shows magnitudes of C_A and A_A for Damper D.

A *torque-force coefficient* serves to represent the force acting on a damper at any particular angular position and is defined as:

$$C_F = \frac{27.7L}{A_s R \cos\alpha}\left(\frac{1}{\Delta P_D}\right) \quad \text{.....(4)}$$

where

C_F = torque-force coefficient, dimensionless.
L = damper equilibrium torque, pound-inches.
A_s = damper area exposed to pressure difference represented by ΔP_D, square inches.
R = distance between center of pressure on A_s and axis of rotation, inches.
α = damper angle, measured as in Figs. 9 and 10, angular degrees.
ΔP_D = damper draft, inches of water.

The product $A_s \cos \alpha$ represents the pressure-surface area projected on a plane that is normal to the duct axis for Dampers A, B and C. For Damper D, A was the area of the curved surface (exposed to $\triangle P_D$) projected on the chord of the surface. The distance R was obtained by assuming that all parts of A_s were exposed to the same pressure-difference force. Table 3 gives magnitudes of A_s and R.

Table 3—Magnitudes of A_s and R

Damper	A	B	C	D
A_s, sq in.	51.1	52.1	61.1	36.6
R, in.	1.50	3.53	0.75	4.88

Torque-force coefficients are summarized in Fig. 12. Comparative drag-coefficient data are shown for a flat plate in a free stream[2]. These indicate the magnitude of the torque-force coefficient which would prevail for a simple flat plate in a free stream with no influence of a supporting frame or adjacent duct walls. That the coefficients for the free plate and the damper should be the same order of magnitude strengthens the principle adopted.

The greater coefficient for Damper C as compared to A and B reflects the influence of sharp edges and a different flow pattern through the bottom of the damper opening.

Coefficients were found independent of W over the test range of drafts.

Discussion

Coefficient data cannot be generalized on the basis of the four exploratory tests reported. The flow-coefficients however are compatible with orifice and nozzle coefficients, and the torque-force coefficients are reasonable in comparison to aerodynamic drag data. Tests to establish coefficients are quite simple, and the present results should serve as a guide for preliminary estimates.

Fig. 13 shows the inter-relationships of Fig. 2 in more specific detail. These curve families are simple and rapid to use, and, from them, it is possible to: (1) predict through-flow performance under any desired condition, and (2) analyze the effects of design changes upon performance. The procedure is based upon physical principles and involves a minimum of experimental data.

Extension of the program as outlined would establish additional relationships to link with those of Fig. 13, until eventually the entire draft system would be studied.

Conclusions

1. The entire torque *vs.* position relationship is controllable by design, and attainable possibilities do not appear to have been exhaustively analyzed in current practice.

2. Flow coefficients and torque-force coefficients offer a simple basis for treating through-flow characteristics.

3. Results obtained are favorable to the concept that barometric draft controls and draft systems may be designed or matched to meet preestablished requirements in terms of: (*a*) desired appliance performance (*b*) known chimney performance, (*c*) adequate flow and thermal data for the flue sections connecting the appliance and the chimney, and (*d*) analytical methods of developing or diagnosing draft-control performance.

References

1. Unpublished preliminary material on file at ASHVE Research Laboratory.

2. Applied Aerodynamics, by L. Bairstow (Longmans, Green and Co., London, First Edition, 1920, Page 126.)

APPENDIX A

Design Considerations and Further Possibilities

The Equation of the Torque-Position Curve

For rigid rotating damper assemblies, the torque-position relation is Equation 1,

$$L = Wr \sin\phi$$

If there are forces involved from springs, bellows, eccentric-suspended weights, or the like, the relationship becomes

$$L = Wr \sin\phi + f(\phi) \quad \text{.....(5)}$$

where $f(\phi)$ is the net contribution of these latter. Damper C is an example of this type.

Considering only the simple rotating Dampers, A, B and D, the torque princi-

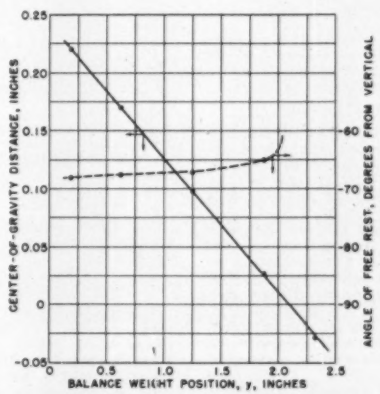


Fig. 14—Angles of free rest and center-of-gravity distances for Damper A

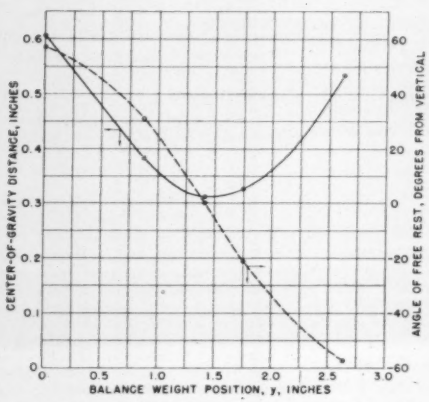


Fig. 15—Angles of free rest and center-of-gravity distances for Damper B

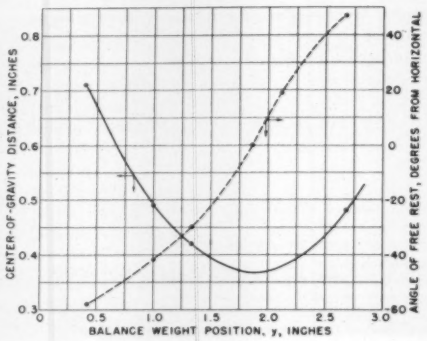


Fig. 16—Angles of free rest and center-of-gravity distances for Damper D

ple is well illustrated by giving the center-of-gravity location as a function of balance-weight position; see Figs. 14, 15 and 16.

The center-of-gravity location requires two coordinates, one a distance from the axis of rotation, r, and the other an angle. The angular positions for the torque curves, Figs. 5, 6, 7 and 8, were referred to arbitrary convenient damper positions. Let α denote this angular scale, taking positive α in the direction of an opening damper. Let α_0 denote the free-rest position on the α scale, as given in Figs. 14, 15 and 16. Then, with ϕ the angle from free rest,

$$\phi = \alpha - \alpha_0 \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Equation 1 on the α scale is then

$$L = Wr \sin (\alpha - \alpha_0) \quad \ldots\ldots\ldots\ldots\ldots (7)$$

The method for determining r was to find the sine curve, Equation 7, which gave the best fit to the test points over the entire range of the data.

Design Comments

In accord with the impression from existing practice that an analytical design approach has not generally been followed, a few comments may be pertinent.

Features of Shape and Assembly

Damper shapes observed have had the simplest form consistent with a good appearance and economy of manufacture from sheet stock. What few cast or machined parts might be employed were of an inexpensive nature. Liberal tolerances were generally evident. An occasional factory-set compensation of the balance system was noted. Parts were generally, but not exclusively, enameled or otherwise rust-proofed. Design Recommendations:

1. When flow-test data are available, it may become justifiable, and equally economical, to consider other than simple circular or rectangular damper shapes.

2. If discrepancies in torque characteristics between supposedly identical dampers are found serious, some sort of factory-set compensation may be justifiable to maintain the design torque relationship.

3. It would be helpful to keep the supports for the rotating parts and all movable elements of the balance-weight adjustment accessible and in view. Disassembly for cleaning should be simple.

4. Materials should not permit easy corrosion and should withstand temperatures encountered.

Nature of the Balance-Weight Adjustment

Several types of adjustment have been observed. No extensive recognition seems to have been given to the role of this adjustment in locating the center of gravity. Design Recommendations:

1. Give careful study to the influence of the balance weight and its adjustment upon the torque-position curves. A simple relationship between balance-weight position and actuating draft would be very helpful for adjustments in the field, and a setting scale might be developed.

2. Consider how sensitive the location of the center of gravity should be made to slight variations in balance-weight settings. This is largely controlled by the shape of the adjustment member.

Weight of Rotating Parts

Table 1 includes the weight data for the dampers tested. These will serve as representative figures. The less the weight, the less will be the inertial resistance to draft disturbances and the more rapid will be the response of *on-off* appliance operation. Design comments are:

1. A lightweight damper can be made more sensitive than a heavy damper to slight changes in draft conditions; on the other hand, its low inertia may give *flutter* tendencies.

2. A damper made of thicker stock should have greater durability and better withstand thermal expansion effects.

Suspension of Moving Parts

Three types of suspensions have been noted, namely: (1) bearings, (2) axis rolling along track, and (3) springs. What happens to different suspensions when subjected to the dirt and temperatures encountered in the field has not yet been observed, but it seems that a thoughtful design could avoid difficulties.

Further design considerations may be justified to obtain different torque curves by means of:

1. A practical suspension which will vary the distance between the center of gravity and the axis of rotation as a function of damper position.

2. Incorporation of springs, bellows, or eccentric weights in the suspension.

Support Friction

Friction at the supports has been found very small for *new* dampers. The effects of severe service conditions have not been investigated. Design refinements are possible to reduce friction still further if needed and economically warranted.

Torque-Position Relation

The relation between balancing torque and angular position is a sine curve for rigid dampers rotating about a *line* axis and which do not employ external forces to influence the balance. Various further possibilities are:

1. Some means of varying the location of the center of gravity of the rotating parts as a function of damper position.

2. Introduction of spring forces, or something similar such as bellows.

3. Use of auxiliary weights to give a torque independently variable with angular damper position.

Designers should give thought to the question of stability as related to the torque-position curve. Automatic adjustment of the torque-position relationship in accord with other combustion controls also may offer advantages.

Center-of-Gravity Location

A design pre-determination of the location of the center of gravity allows the entire torque-curve relationship to be predicted without need for tests. Variations appear innumerable, and exhaustive explorations are not evident.

Flow and Torque Coefficients

Possibilities from changes in damper and flow-passage forms do not appear to have been investigated.

Committee on Research Holds Spring Meeting

The Committee on Research held a spring meeting at the Research Laboratory, Cleveland, Ohio, Thursday, April 19, with Chairman I. W. Cotton presiding.

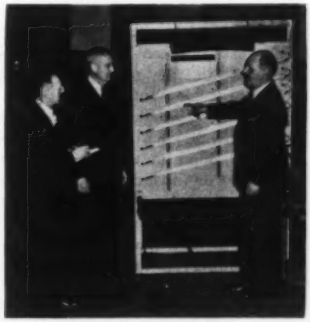
Director of Research Cyril Tasker reported on the contacts he had made with various agencies in the Research and Development Branch in the Department of Defense, and said that details were given of the Society's facilities and staff for carrying on fundamental research on problems in heating, ventilating, air conditioning, and related fields. The Committee then discussed how, and to what extent, the Society's research facilities might be used for government projects, and it was decided that the Chairman should keep the government officials and agencies informed concerning the type of research which the Society conducts without interfering too greatly with the current research program as approved by the Council for the fiscal year 1951.

The members of the Committee inspected the progress of the environment laboratory, now nearing completion. All major equipment items for this important facility have been delivered, most of the construction is completed, and instrumentation is now actively under way. It is recognized by the Committee that the first series of tests in the environment laboratory would be concerned with problems under Group B of the Technical Advisory Committee on Panel Heating and Cooling; namely, the investigation of heat transfer between heated and cooled panels, the adjoining surfaces, and the space surrounding the panels. It is also recognized, however, that the Technical Advisory Committee on Sensations of Comfort had a well planned program of research to be conducted in the environment laboratory as soon as the panel heating studies were completed.

After inspecting the environment laboratory, the Committee made a tour of the entire laboratory to examine other facilities and to study projects currently under way.

The Committee considered in some detail the policies underlying the operation of the Committee on Research and the Technical Advisory Committees, and appointed two subcommittees to prepare operational guides for the Committee on Research and for the Technical Advisory Committees in line with the Charter and By-Laws of the Society.

It was also decided by the Committee that they would conduct another survey of membership interest in the research program in the fall of 1951. The Committee recognizes the valuable results that came out in the survey conducted in the 1948-49 winter and felt that a re-analysis would be of considerable value in keeping the Society's long-range research program current and in maintaining the Society's interest in the program.



J. W. Maier, of the Laboratory Staff, points to equipment used in laboratory studies on testing of air cleaning devices for A. B. Algren, Chairman, TAC on Air Cleaning Devices, and I. W. Cotton, Chairman of the Committee on Research

Cooperative Research Contracts

The Committee recommended the renewal of cooperative research agreements at seven institutions for the period July 1, 1951 to June 30, 1952 as follows:

College of Medicine, University of Illinois: Physiological reactions of physically impaired persons to changes in environment.

Case Institute of Technology: Air flow from ceiling outlets.

Kansas State College: The downblow of heated and cooled airstreams.

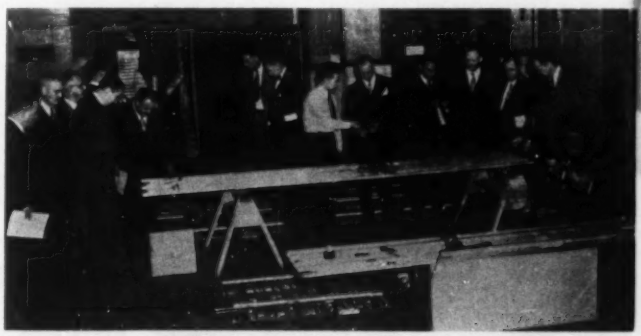
University of Minnesota: Solar energy as a potential heat source for the heat pump.

University of Florida: Air entrainment in hot water heating systems.

Michigan State College: Friction in rectangular off-take fittings.

Cornell University: Studies of the sol-air thermometer and the sol-air temperature concept.

The Committee also recommended the renewal of the research fellowship at the *University of Minnesota* covering field studies on the control of panel heating systems.



Members of the Committee on Research inspect methods of instrumentation on panels for internal surfaces of environment laboratory (*l. to r.*) C. F. Boester, I. W. Cotton (Chairman), Cyril Tasker (Director of Research), R. C. Cross, A. J. Hess, T. H. Smoot, R. D. Madison, L. F. Schutrum (Laboratory staff), John Everetts, Jr., Nathaniel Glickman, H. A. Lockhart, A. V. Hutchinson (Executive Secretary), L. N. Hunter, W. A. Grant, and Prof. A. B. Algren.

Hit The Oregon Trail For The City of Roses Meeting

All roads lead to Portland, Ore., for ASHVE members who will gather from every point in the United States to attend the Society's Semi-Annual Meeting, July 2 to 4.

A large attendance is anticipated for the outstanding program prepared by the Oregon Chapter's Committee on Arrangements, General Chairman Bert W. Farnes reported in urging members to make their reservations as soon as possible. (A mailing piece containing forms both for the Special Events Program and for hotel reservations has been sent to all members.)

Technical Program

Presentation of twelve technical papers at three technical sessions and a luncheon talk will keynote the City of Roses Meeting.

The first technical session will be held on Monday, July 2, at 9:30 a.m., with four interesting and informative papers mainly on panel heating to be presented. The second session is set for Tuesday, July 3, at 9:30 a.m., and again four highly worthwhile papers on warm air heating will be presented. A further technical treat is in store for members July 3 at the City of Roses Luncheon, when Dean G. W. Gleeson, School of Engineering and Industrial Arts, Oregon State College, delivers an address titled, *Energy — Choose It Wisely Today for Safety Tomorrow.* The third and final technical session will be held on July 4, at 9:00 a.m. and once more four excellent papers, three of them on the subject of heat pump applications and design, will be presented.

Entertainment Program

An equally outstanding entertainment program will give members and their families ample opportunity to have fun, to enjoy a reunion with their friends from various parts of the country and to make new friends.

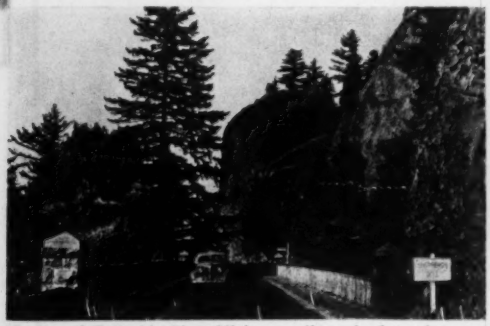
The entertainment program will be launched for the men with a golf tournament on July 2, at noon, and members, whether they are high or low handicap players, will have an equal opportunity for numerous awards. For the ladies, the program will get under way on Monday, at 11:00 a.m., with a Brunch.

While the golf tournament is being held, non-players and their families will make a trip to the Grotto (Sanctuary of Our Sorrowful Mother) and to famed Columbia River Highway. Located at the foot of many waterfalls and rock wall glens, the highway affords an outstanding vantage point to view the surrounding countryside. In the evening, everyone will enjoy an Hawaiian Buffet Dinner Party in an atmosphere of authentic Hawaiian leis and true Island music.

While the Tuesday morning technical session is being held, the ladies will have an opportunity to see Portland's many attractive shops. In the afternoon, all will embark on a trip that should prove to be a memorable scenic experience. A motor cavalcade will take them over roads lined with rhododendrons, manzanita, and squaw grass, to Timberline Lodge, located high on the south slope of majestic Mt. Hood. There they may ride in the ski-lift or sky coach, if they like, or just sit back and enjoy the stirring vistas *of purple mountains' majesty above the fruited plain.* In the late afternoon, all will join at Rhododendron beneath the stars for an Indian-Style Salmon Bake, with entertainment and recreation to follow.

After the technical session on Wednesday morning, members and their families will have choice seats in a special grandstand section to view a Mollala Buckaroo, a unique spectacle of the old west. In the evening, all will gather for the traditional Semi-Annual Banquet and the climax of a meeting that promises to be truly outstanding.

The Oregon Chapter cordially invites all members to come to Portland. They sincerely hope that the Oregon Trail will become the ASHVE trail and lead many members and their families there to make the meeting a part of their vacation in that wonderland of natural beauty.



The famed Columbia River Highway rolls at the foot of numerous waterfalls

The beautiful Pacific Ocean rolls on 400 miles of Oregon coast sands

PROGRAM 1951 SEMI-ANNUAL MEETING

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Portland, Oregon

July 2, 3 and 4

(All Events Scheduled on Pacific Daylight Time)

Sunday—July 1

9:00 a.m. REGISTRATION
Council Meeting
2:00 p.m. Sightseeing tours about City with Chapter Members in private cars

Monday—July 2

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION
Aluminum Ceiling Panels for Heating and Cooling, by E. S. Howarth, S. C. Huddleston and R. M. Koch
Laboratory Studies of the Thermal Characteristics of Plaster Panels, by C. M. Humphreys, C. V. Franks and L. F. Schutrum
Optimum Panel Surface Distribution Determined from Human Shape Factors, by F. W. Hutchinson and Merl Baker
*Barometric Draft-Control Analysis, by H. B. Nottage, D. W. Locklin and R. G. Huebscher
11:00 a.m. Ladies Brunch
12:30 p.m. to 5:30 p.m. Research and Eichberg Cups Tournament, Glendoveer Course
12:30 p.m. Columbia River trip with snack at Multnomah Falls
7:00 p.m. Hawaiian Buffet Dinner Party — Dinner-Entertainment-Dancing

Tuesday—July 3

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION
Control of Air Streams from a Long Slot, by Alfred Koestel and Chia-Yung Young
Pressure Losses of Take-Offs for Extended-Plenum Duct Systems, by J. W. Holl, S. F. Gilman, R. J. Martin and S. Konzo
Warm Air Perimeter Heating — Heat Emitted from Floor Surface, by J. R. Jamieson, R. W. Roose and S. Konzo
*Furnace Thermal Efficiency Determined from Flue and Jacket Loss, by H. L. McPherson, K. L. Badger and W. S. Zawada
10:00 a.m. Ladies Shopping Tour
12:00 noon Luncheon
Toastmaster: J. Donald Kroeker
Speaker: Dean G. W. Gleeson, School of Engineering and Industrial Arts, Oregon State College
Subject: "Energy — Choose It Wisely Today for Safety Tomorrow"
1:30 p.m. Nominating Committee
2:00 p.m. Scenic motor trip to Timberline Lodge and Mt. Hood
6:00 p.m. Indian Salmon Bake at Mt. Hood

Wednesday—July 4

9:00 a.m. REGISTRATION
9:00 a.m. TECHNICAL SESSION
Heat Pump Application to a Newspaper Plant, by J. D. Kroeker, J. H. Bonebrake and J. A. Melvin
Two-Year Performance of a Heat Pump System Furnishing Year-Round Air Conditioning in Modern Office Building, by Philip Sporn and E. R. Ambrose
Climatology as an Aid in Heat Pump Design, by G. S. Smith
*Heat Requirements of Buildings, by C. W. Signor
10:00 a.m. Mollala Round-up
1:30 p.m. †Inspections — Country's two largest heat pumps
7:00 p.m. Semi-Annual Banquet
Toastmaster: T. E. Taylor
Speaker: Frank Branch Riley, Lecturer
Subject: "The Last West"

*To be presented by title

†Also available 10:00 a.m. July 5.

Method of Choosing Location of, Financing and Conducting Meetings of the Society

Resolved: That inasmuch as the Annual and Semi-Annual Meetings of the Society come under the jurisdiction of the Council, the following rules governing the handling of such meetings be adopted by the Council and published in the JOURNAL of the Society at least twice during every year, preferably just prior to each meeting.

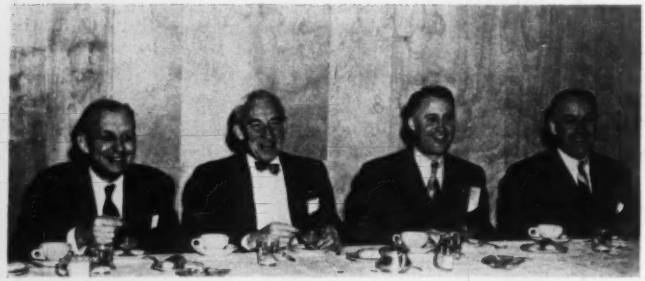
1—The Council will select the city in which the Annual or Semi-Annual Meeting is to be held, giving due consideration to the invitations received from Chapters or members as well as to the advisability of so distributing those meetings as to make them of the greatest advantage to the general membership, and to reduce as far as possible the expense of members attending.
2—That an appropriation be made to cover the entertainment or local expenses, incurred in connection with the meeting, and the regular meeting expense to be taken care of by the General Fund of the Society in the regular way.
3—That no registration fee or compulsory obligations of any nature be imposed on members or guests.
4—That the purchase of tickets for banquets or for any other form of entertainment that may be provided be entirely voluntary.
5—That the grouping of features and the sale of tickets for group features be discouraged.
6—That the raising of funds from manufacturers of heating apparatus be discouraged.
7—That the display of samples, or of literature, advertising the product of any manufacturer in any way, shape or form, be not permitted at the booths, registration desk, or in or about the meetings.
8—That the distribution of trade papers be entirely at the discretion of the committee in charge.
9—That the local Chapter or local members be empowered to form a General Committee with such sub-committees as may be required to handle the details of transportation, hotel accommodations, entertainment, finance, etc., and that this General Committee be requested to confer frequently with the Council, through the Executive Secretary of the Society, and to make frequent reports on progress in connection with the various matters being handled by them.
10—That the arrangements of elaborate and costly entertainment features be discouraged.

Adopted at Council Meeting, January 29, 1926.

Summary of Chapter Meetings*

MASS. CHAPTER'S PROGRAM POINTS OUT CAREER OPPORTUNITIES FOR STUDENTS

To provide engineering students with some idea of the career opportunities offered in the heating and ventilating field, a special program on the subject was arranged for them by the Massachusetts Chapter and presented as a part of the regular monthly meeting at the Massachusetts Institute of Technology, April 17.



Addresses by (*l. to r.*) R. T. Kern, Prof. G. B. Wilkes, W. H. Shipp, and T. G. Gallagher highlighted the recent program arranged by the Massachusetts Chapter to give student engineers some idea of the career opportunities in the heating and ventilating field

Students from M.I.T., and from nearby colleges and trade schools, were invited and a large number attended. Aptly titled, *Opportunities and Prospects for the Heating and Ventilating Engineering Student*, the program was featured by addresses covering four phases of the business.

The first speaker was Gordon B. Wilkes, professor of mechanical engineering, M.I.T., who spoke on his experience in consulting and research work.

The second speaker was R. T. Kern, past president of the Massachusetts Chapter and chief engineer, Jennison Co., Fitchburg, Mass., who spoke of the present opportunities for technical engineers in the heating and ventilating field. He emphasized the value of experience gained by working for various concerns, but advised the students not to become *rolling stones*. He closed his talk by stressing the importance of reading trade magazines and continuing their studies after graduation.

The third speaker was W. H. Shipp, a past president of the Massachusetts Chapter, and manager, Commercial Controls Division, Minneapolis-Honeywell Regulator Co., Boston, who spoke on the subject, *Sales Engineering*. Mr. Shipp expressed the opinion that, to make a successful sales engineer, *you must win the customer's confidence and know your product and its application*. He also touched on the importance of working with the consulting engineer to get your product specified and of customer contact during the installation, to insure the correct application and satisfying service.

The fourth speaker was Thomas G. Gallagher, president, Thomas G. Gallagher Co., Boston, Mass., who spoke on *Contracting*. He advised those wishing to become successful contractors to get some practical experience when they leave school and follow this up by work in installation, supervision, estimating, drafting, junior engineering, purchasing, financing, and engineering.

Pres. D. W. Blair presided. Attendance 75. Attendance ratio 0.31.

• *MASSACHUSETTS*—March 20, 1951. Following the social hour and dinner held in the Campus Room of the M.I.T. Graduate House, Vice Pres. John Bonner, presiding officer in the absence of Pres. D. W. Blair, welcomed members and guests. L. E. Seeley, president of the society and dean, College of Technology, University of New Hampshire, Durham, N. H., was one of the guests of the evening, and delivered a brief address.

Vice President Bonner introduced the speaker of the evening, John W. James, chief research engineer, McDonnell & Miller, Inc., Chicago, Ill., who spoke on *Operating Characteristics of Hot Water Heating Systems*. Mr. James' talk covered the various aspects of pipe layouts, expansion tanks, safety controls, relief valves, circulators and hot water heating system accessories and was accompanied by slides. Mr. James stressed the importance of proper controls and relief valves to prevent serious accidents due to boiler failures. The talk was well received and was followed by a short discussion period. Attendance 57. Attendance ratio 0.43.

• *ATLANTA*—April 9, 1951. The meeting was called to order by Pres. E. K. Jamison at 7:55 p.m. in the Sara Holcombe Tea Room, following

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

a social hour and dinner. The minutes of the previous meeting were read and approved and the treasurer made a financial report. H. W. Harrison, chairman of the membership committee, requested that all members join in soliciting new members; and Lon Sheahan suggested that more meeting programs be devoted to application engineering, in order to attract contractors and installers. President Jamison reported on plans for the spring social to be held on May 11 at the Ansley Park Golf Club, and requested immediate reservations since only a limited number of couples could be accommodated.

C. B. Cole introduced the guest speaker of the evening, W. W. Wise, heating engineer and contractor, who gave a very interesting and practical talk on *Playing with Fire*. Attendance 35.

• *BALTIMORE*—April 18, 1951. The board of governors meeting and a social hour and dinner in the Engineers Club, preceded the opening of the regular business meeting at which E. L. Crosby presented W. I. Collier with a Life Membership Certificate.

E. R. Kent presented the speaker of the evening, R. S. Dill, chief, Heat and Air Conditioning Section, National Bureau of Standards. Mr. Dill spoke on *Research in Domestic Heating in the United States*, mentioning many of the country's research centers and touching upon some of the activities going on at each.

Following Mr. Dill's address, Mr. Crosby presented the nominating committee's report and it was announced that the elections would be held at the May meeting. Attendance 38. Attendance ratio 0.39.

• *CENTRAL NEW YORK*—March 21, 1951. Pres. A. L. Jones called the meeting to order in the Powers Hotel, Rochester, N.Y., at 8:25 p.m. and members and guests introduced themselves. The minutes of the two previous meetings were read and approved, and this was followed by the reading and approval of the treasurer's report. Following the report of the nominating committee President Jones appointed the auditing committee as follows: W. L. Lynch, J. J. Springer, and H. V. Boggs.

N. E. Sheldon introduced the speaker of the evening, Lawrence Macrow, district chief engineer, Carrier Corp., Philadelphia, Pa., who spoke on *Four Season Air Conditioning for Multi-Room, Multi-Story Buildings*. Attendance 41.

• *CENTRAL OHIO*—March 19, 1951. Pres. H. G. Hays called the meeting to order at 8:00 p.m. in the Southern Hotel and the minutes of the February meeting were read and approved. R. S. Curl made a report on the new State Code Committee, and R. J. Schmitz, Jr. and President Hays discussed the problem of promoting better attendance at meetings. A nominating committee was appointed as follows: M. McG. Swepston, F. C. Seabright, and R. B. Breneman.

W. A. Schoonover introduced the speaker of the evening, R. U. Berry, manager, Industrial Marine and Contractor Division, Air Conditioning Department, General Electric Co., Bloomfield, N.J., who was accompanied by Robert Armstrong of General Electric's Cleveland office. Mr. Berry spoke on *Air Conditioning of Multi-Room Buildings*. Attendance 16. Attendance ratio 0.19.

• *CINCINNATI*—April 2, 1951. The meeting was called to order at Engineering Society Headquarters by Pres. E. W. McNamee at 8:00 p.m., and the minutes of the March meeting and the treasurer's report were read and approved. President McNamee announced a change in the chapter by-laws, which provided for the addition of a treasurer to the group of chapter officers, and K. B. Little gave the report of the nominating committee. An auditing committee was appointed as follows: R. J. Hanschen, R. G. Anderson, F. W. Wilson.

The speaker of the evening was Carl F. Boester, housing consultant, Purdue Research Foundation, Purdue University, Lafayette, Ind., who spoke on *New Practices in High Temperature Forced Hot Water Heating*. According to the secretary's report, Mr. Boester's excellent address was greatly appreciated and well received by his audience. Attendance 41. Attendance ratio 0.31.

• *CINCINNATI*—March 6, 1951. The meeting was called to order by Pres. E. W. McNamee at Engineering Society Headquarters at 8:00 p.m. and the minutes of the February meeting were read and approved.

H. E. Sproull introduced Prof. E. R. Queer, of the Engineering Experiment Station at The Pennsylvania State College, State College, Pa., who discussed the *Water Tunnel Building at Penn State*. He mentioned that it is the largest in the world and that it was built since World War II under Navy sponsorship. It has a water rate of 60 mph and requires 300 tons of refrigeration to maintain water temperatures.

R. J. Hanschen introduced E. A. Sobolewski, a prospective member of the Society; and R. C. Beineke announced that Carl F. Boester, Lafayette, Ind., would be the guest speaker at the April meeting.

The meeting was then turned into a panel discussion with F. W. Wilson acting as moderator. The members of the panel were: William Jackes and M. E. Mathewson, both engineers; I. B. Helburn and K. E. Little, sales representatives; and F. B. DeBra and J. J. Bechtol, contractors. Seven timely questions were presented to the panel and each was followed by an interesting and lively discussion. Attendance 42. Attendance ratio 0.42.

• *CONNECTICUT*—March 15, 1951. Pres. D. M. Hummel called the meeting to order at 8:30 p.m. and

the minutes of the last meeting and the treasurer's report were read and approved. S. R. Osborne, chairman of the nominating committee, presented the committee's nominations for officers for 1951-52.

The speaker of the evening was John W. James, chief research engineer, McDonnell & Miller, Inc., Chicago, Ill., who spoke on the subject *Operating Characteristics of Hot Water Heating Systems.* A lively discussion period followed the talk. Attendance 78. Attendance ratio 0.29.

• *DELTA*—April 10, 1951. The meeting was called to order by Vice Pres. Theodore Offner, the presiding officer in the absence of Pres. Ralph Elizardi, in the Trophy Room of the New Orleans Athletic Club. Members introduced themselves and their guests and the minutes of the March 13 meeting were read and approved. Vice President Offner read a letter from the Penn Electric Switch Co. inviting Chapter members to attend a meeting at the St. Charles Hotel on April 16 and 17 on heating and refrigeration.

R. K. Goode introduced the speaker of the evening, R. K. Rothrock, sales engineer, who spoke on *Radiant Heat —A Combustion Tool.* The talk was followed by a question and answer period, after which a rising vote of thanks was given to Mr. Rothrock for his presentation. Attendance 45. Attendance ratio 0.39.

• *DELTA*—March 13, 1951. Pres. Ralph Elizardi called the meeting to order in the Trophy Room of the New Orleans Athletic Club, and members introduced themselves and their guests. The minutes of the January 9, January 20 and February 12 meetings, the latter two being joint sessions, were read and approved. President Elizardi presented R. B. Guest with a past president's certificate and a rising vote of thanks was given to Mr. Guest for his *adherence to duty and wise leadership* as president of the Delta Chapter during 1949-50. L. R. Maxwell announced that the Shreveport Chapter of ASHVE had expressed a desire to hold a joint meeting with the Delta Chapter, possibly in May. It was decided that the board of governors would work out the rest of the details concerning the joint meeting.

The speaker of the evening, G. E. Sullivan, instructor at the College of Engineering at Tulane University, spoke on *Sol-Air Temperature Data for New Orleans.* Attendance 44. Attendance ratio 0.20.

• *GOLDEN GATE*—March 1, 1951. Pres. R. C. Cushing called the meeting to order in the Engineers Club, San Francisco, and members introduced themselves and their guests. E. F. Dill, membership chairman, announced the names of three new Chapter members, John Hellstrom, R. C. Taylor, and G. N. Aranovsky. President Cushing called for discussion on adopting new chapter by-laws and it was finally moved and unanimously voted upon that the new by-laws, with the changes recommended, be adopted.

D. B. Kirby gave an interesting talk on *What an Architect Expects of an Engineer,* and also spoke on state legislation and its effect on the building industry. Attendance 78.

• *ILLINOIS*—April 9, 1951. Pres. P. J. Marschall opened the meeting by reading the Committee on Research Report, showing how the Society's research program has grown since 1940. This was followed by the introduction of new members and out-of-town guests and the appointment of the auditing committee as follows: H. E. Clo, *chairman,* C. O. Anderson, and C. A. Gustafson. The film, Come to Oregon, being shown to chapters throughout the country in order to promote attendance at the Semi-Annual Meeting, was then shown.

The meeting was turned over to E. P. Heckel, Jr., who introduced the speaker of the evening, R. A. Johnson, district representative, Chrysler Airtemp Sales Corp., Chicago, Ill. Mr. Johnson spoke on *Uses of Packaged Air Conditioners,* and began by defining room coolers as units of 1½ hp, and under, and described packaged conditioners as self-contained units of 2 hp, and over. He stated that approximately 45,000 room conditioners were sold in 1948 as compared to 185,000 in 1950, and that sales for this year are expected to reach 300,000 to 400,000 if there are no material shortages or other restrictions. He also reported a similar growth in annual sales of packaged conditioners.

Mr. Johnson stated that the package unit, together with relatively simple selection data provided by manufacturers, may permit a contractor with little engineering knowledge or skill to enter the air conditioning business. He added, however, that it is quite easy to install a unit or a system of units which will result in unsatisfactory conditions.

In discussing applications, he pointed out that the room cooler and the packaged air conditioner are ideal in many cases, since they are relatively inexpensive and provide flexibility, in that equipment may be relocated to suit remodeling. He stated that it is difficult, however, to apply packaged units to large installations where equipment must be concealed. Attendance 116. Attendance ratio 0.20.

• *INLAND EMPIRE*—April 6, 1951. The reading and approval of the minutes of the previous meeting and the treasurer's report constituted the first order of business, following the opening of the meeting by Pres. W. C. Vradenburg. A report on the board of governors meeting was given and L. E. Marque reported that Dean L. E. Seeley, College of Technology, University of New Hampshire, Durham, N. H., would be the speaker at the next meeting. G. M. Dieter gave a report for the attendance committee and stated that Dr. Dana and Sherman Markley of Washington State College and Dean McGivran of Gonzaga University, Spokane, were also to be invited to the next meeting.

Following the presentation of a number of committee reports, Mr. Marque introduced the speaker of the

evening, Mr. Allen of the Washington Rating Bureau. Mr. Allen spoke on building insurance rates with various types of tank and burner installations. Attendance 15.

• *IOWA*—March 13, 1951. Members and guests met at the Standard Club. Pres. R. S. Stover called the meeting to order at 8:00 p.m. and the roll of members was called and the guests introduced. The minutes of the January 16 and February 13 meetings were read and approved. A preview of the forthcoming Society meetings up to and including the 1953 Annual Meeting was then presented for the members.

The meeting was turned over to C. H. McGuiness, who introduced the speakers scheduled for the evening. The first speaker, Louis Van Hoesen of the National Production Authority, spoke on the reasons for the construction control, explained the function of the federal agency and outlined the individual's part in helping to carry out the regulations.

The next speaker, Clyde Lighter, discussed the possible future effects of the restriction on construction and construction materials as seen from the architect's viewpoint. He also gave a brief outline of existing regulations.

The last speaker, Louis Kurtz, centered his talk on the future outlook as to the availability and delivery of construction materials from the supplier's point of view. Attendance 34.

• *IOWA*—February 13, 1951. Members of the Electrical, Mechanical and Railroad Section of the *Iowa Engineering Society* and the Iowa Chapter of the ASHVE met jointly in the Kirkwood Hotel on February 13, 1951. Mr. Gebuhr of the *Iowa Engineering Society* was the presiding officer and called the meeting to order.

The speaker of the evening was J. B. McMahon, president of the *Instrument Society of America*, who spoke on *Factors which Affect Control*. Mr. McMahon gave an interesting talk, accompanied by slides, which illustrated different methods of controlling equipment and demonstrated the importance of the correct selection of control sequence to accomplish the desired results. There was a large membership attendance for both societies.

• *KANSAS*—April 3, 1951. The meeting was called to order in the Walnut Room of the Lassen Hotel at 8:00 p.m. by Pres. R. F. Bauer, following a social hour and dinner. Members present introduced themselves and their guests and the minutes of the previous meeting were read and approved. Secretary E. G. Fahnestock reminded the members that the City of Wichita Department of Services had requested that the chapter prepare a code covering the installation of air conditioning, heating and refrigeration in all its phases. He brought out that certain difficulties are arising because of the lack of such a code.

The speaker of the evening was J. L. Bradfield, owner, Brad-Ray Products, Indianapolis, Ind., who spoke on the subject of ceiling warming systems.

At the conclusion of the meeting it was announced that the speaker for the May meeting would be Charles Neeson of the Airtemp Division of Chrysler Corp. Attendance 29. Attendance ratio 0.40.

• *KANSAS CITY*—April 2, 1951. Members and guests met in the Roof Garden of the Aladdin Hotel, Kansas City, Mo., and the meeting was called to order by Pres. W. E. Howarth. Two new chapter members, G. L. Oswald and D. R. Hettelsater, were introduced by W. E. Howarth. The minutes of the March 5 meeting were read and approved, and reports were given by the treasurer and the membership chairman. C. W. Schumacher, program chairman, announced that Charles Neeson of Chrysler Corp. would be the speaker at the next meeting, and that Mr. Neeson's subject would be *High Speed F-12 and F-22 Compressors.*

C. V. Werner introduced the speaker of the evening, J. L. Bradfield, owner, Brad-Ray Products, Indianapolis, Ind., who explained the installation of various types of radiant panel heating systems. The talk was followed by an interesting discussion period. Attendance 55. Attendance ratio 0.26.

• *MANITOBA*—March 28, 1951. The opening of the meeting by Pres. C. M. Fleming in Salon A of the Fort Garry Hotel was followed by the reading and approval of the minutes of the February meeting. The speaker of the evening, G. L. Ballantyne, manager, Heating Department, Crane Co., Ltd., Montreal, gave an informative address on *Baseboard Heating*. Following a short discussion, the phone committee for the next meeting was appointed as follows: J. C. Stangl, E. R. Miller, and D. F. Michie. Attendance 25.

• *MEMPHIS*—March 19, 1951. Following dinner, Pres. C. S. Fischer called the meeting to order at 8:10 p.m. in the King Cotton Hotel, and introduced and welcomed the guests. The minutes of the previous meeting and the treasurer's report were read and approved. R. H. Hoshall, chairman of the nominating committee, submitted the committee's report on nominees for 1951-52 officers. J. P. Manis extended an invitation to the members to visit the *Parade of Progress* exposition sponsored by Minneapolis-Honeywell Regulator Co. at the King Cotton Hotel, March 21. President Fischer announced that the April meeting would feature a discussion on panel heating.

R. E. Larkin introduced C. W. Wheeler, assistant sales manager, The Ric-wiL Co., Cleveland, Ohio, the speaker of the evening. Mr. Wheeler discussed over-head and underground steam distribution, supplemented by lantern slides, illustrating certain phases of this subject. Following a discussion period, President Fischer thanked Mr. Wheeler on behalf of the Chapter. Attendance 33.

• *MICHIGAN*—April 16, 1951. Seventeen past presidents of the Michigan Chapter, most of them with their wives, and many Chapter members and their wives were in attendance at the Chapter's April 16 meeting. Past presidents who attended were: Messrs. Harms, Harrigan, Johnson, Calvert, Boales, Giguere, McConachie, Winans, Wallich, Randall, Tuttle, Kilner, Sanford, Old, Connell, Hyde, and Burch.

The meeting was held in the Engineering Society of Detroit Building and was called to order by Pres. C. F. Donohoe immediately following dinner. At the conclusion of the introduction of guests, Past Pres. E. F. Hyde presented the past president's pin to L. A. Burch, Chapter president during 1949-50.

Following a short social period, Harvey Campbell, executive vice president of the Detroit Board of Commerce, gave an inspiring address entitled *Where Is Detroit Going*. Mr. Campbell pointed out that although in the past the City of Detroit has been justly criticized for poor city planning, he is thoroughly convinced that the city is entering into an era of unprecedented progress for the development of Detroit as a finer and more beautiful place in which to live. Mr. Campbell's talk was well received as indicated by the enthusiastic applause he received. Attendance 102.

• *MINNESOTA*—April 2, 1951. Pres. G. M. Kendrick opened the meeting in the Garden Room of the Dyckman Hotel, Minneapolis, and introduced the guests of the evening. The minutes of the March meeting were read and approved and following discussion of a few items of Chapter business, the ballots were passed out and J. A. Craig, F. W. Legler, and D. L. Vandergon were appointed as tellers.

While the ballots were being counted, J. E. Haines, member of Council and local Chapter member, was introduced and spoke briefly about the Society. E. F. Snyder then introduced the speaker of the evening, H. A. Lockhart, chief engineer, Bell & Gossett Co., Morton Grove, Ill., who spoke on *Panel Heating and Cooling*. Mr. Lockhart's talk was very interesting, and was followed by a lively discussion period.

President Kendrick announced the results of the election of officers for 1951-52 as follows: *president*—E. F. Snyder; *vice president*—William Sturm; *secretary*—J. A. Holbrook; *treasurer*—V. E. Pearson; *board of governors*—G. M. Brown and L. J. Krause; *representative to Minnesota Federation of Engineering Societies*—A. B. Algren; and *alternate representative*—C. E. Gausman. Attendance 115. Attendance ratio 0.36.

• *MONTREAL*—March 19, 1951. Pres. R. R. Noyes called the meeting to order at 6:30 p.m. in the Berkeley Hotel and the minutes of the February meeting were read and approved as read. It was announced that the code committee had been appointed and consisted of the following members: L. C. A. Walford, *chairman*, Y. R. Tasse, *advisor*, and R. R. Duquette.

The speaker of the evening, I. M. Bodine, general sales manager of Keeprite Refrigeration Ltd., was introduced by J. D. Ross and thanked for his presentation by Mr. Walford. Attendance 48.

• *NEBRASKA*—April 10, 1951. Pres. G. W. Colburn was the presiding officer at the meeting, which was held in the Hotel Castle, Omaha, Nebr. The feature of the evening was the address on *Air Conditioning Systems Progress* given by C. L. Ringquist, manager of the Air Conditioning Department, The Trane Co., LaCrosse, Wis. Mr. Ringquist's talk gave very comprehensive information regarding the installation and air distribution of air conditioning equipment in large buildings. An interesting discussion period followed the talk. Attendance 33. Attendance ratio 0.31.

• *NEBRASKA*—March 20, 1951. Members and guests met at the Hotel Castle, Omaha, and Pres. G. W. Colburn called the meeting to order at 6:45 p.m.

The speaker of the evening was Fred Downs, branch manager, York Corp., Omaha, who spoke on *Small Town Theater Air Conditioning*. Mr. Downs' presentation was interesting and informative and was followed by a discussion period. Attendance 29. Attendance ratio 0.31.

• *NORTH CAROLINA*—April 13, 1951. Following a social hour and dinner, Pres. R. O. McGary called the meeting to order at 8:00 p.m. in the Selwyn Hotel, Charlotte, N. C., and the minutes of the February meeting were read and approved. Reports were given by W. D. Graham, Jr., membership chairman, on the progress made in contacting prospective members, and J. W. Barr, program chairman, on tentative plans for the Chapter's annual summer meeting in June.

C. W. Brown, special agent in charge of the Southern Area of the Federal Bureau of Investigation, was the speaker of the evening. Mr. Brown spoke of the origin of the F.B.I. and its place in the U.S. Government as the investigating arm of the Department of Justice. According to the secretary's report, the talk was highly interesting and instructive and a letter of appreciation was sent to Mr. Brown. Attendance 60.

• *NORTHEASTERN OKLAHOMA*—April 10, 1951. Members and guests met at Smith's Restaurant for dinner, after which Pres. R. F. Shoemaker called the meeting to order and the minutes of the preceding meeting were read, corrected, and approved. Otto Karn, refrigeration and boiler inspector for the city of Tulsa, was called on to briefly explain the newly drafted Refrigeration and Air Conditioning Code.

The meeting was turned over to C. H. Dollmeyer, Jr., program chairman, who introduced R. L. Maher, engineer, Chase Brass & Copper Co., Waterbury, Conn. Mr. Maher gave a very interesting, illustrated talk

on *Radiant Heating*, which was followed by a lengthy discussion period indicating the interest the talk had created. Attendance 22. Attendance ratio 0.50.

• *NORTHEASTERN OKLAHOMA*—March 13, 1951. The business meeting was called to order at 7:30 p.m. by Pres. R. F. Shoemaker, following dinner at Smith's Restaurant. The roll call was taken and the minutes of the previous meeting were read and approved. The meeting was then turned over to C. H. Dollmeyer, Jr., program chairman, who introduced G. A. Voorhees, director, application engineering, *National Warm Air Heating & Air Conditioning Association*, announcing that Mr. Voorhees had just completed a two-day warm air heating conference in Tulsa. Mr. Voorhees made a few remarks about the Association explaining that it was organized 33 years ago at the University of Illinois and that research work has been going on continuously since that time.

The principal speaker of the evening, L. E. Seeley, president of the Society and dean, College of Technology, University of New Hampshire, Durham, N. H., was then introduced. Dean Seeley spoke on *Engineering With a Human Touch* stating that he had conducted a series of tests determining the human reaction to temperatures ranging from 10 to 130 F. Dean Seeley explained that he, himself, had taken part in these tests, along with others. A question and answer period followed the talk. Attendance 33. Attendance ratio 0.82.

• *OKLAHOMA*—April 9, 1951. Pres. R. E. Swan presided and called the meeting to order at 8:00 p.m. in Beverly's Drive-In, Oklahoma City, Okla., and a short sound motion picture entitled *Let's Go Fishing* was shown through the courtesy of the Beech Aircraft Co.

The speaker of the evening was J. O. Mitchell, assistant public relations manager, Wichita Division, Boeing Airplane Co., Wichita, Kan., who spoke on *The Gas Turbine*. Mr. Mitchell began by giving a brief description of the gas turbine, its principles and the reasons for its design. He then showed a sound motion picture, demonstrating the application of a particular turbine, which he had described, in a transport truck and in a Navy personnel carrier. Following the showing of the film, he showed a series of slides demonstrating comparative efficiencies and fuel consumption of the gas turbine and other prime movers now being used for a similar purpose. Attendance 67. Attendance ratio 0.50.

• *ONTARIO*—April 4, 1951. The first order of business following dinner and the official opening of the business meeting by Pres. J. H. Fox in the Royal York Hotel, was the introduction of two new Chapter members, J. G. Priestman and D. M. Dymond. President Fox read the report of the nominating committee and announced that elections would be held at the May meeting. A Life Membership Certificate was presented to A. J. Dickey by President Fox, and Mr. Dickey spoke briefly to the Chapter wishing it continued success.

Laurence Milligan, of Robbins & Myers Co. of Canada, Ltd., the speaker of the evening, addressed the Chapter on *Motor Problems in Heating and Air Conditioning*. Attendance 96. Attendance ratio 0.31.

• *OREGON*—April 5, 1951. Pres. R. C. Chewning called the meeting to order in the Old Heathman Hotel and the minutes of the previous meeting were read and approved. President Chewning called for reports by the secretary and treasurer, and then proceeded to summarize for the members the annual reports submitted by the chapter committees.

H. W. McKenzie introduced George Rider, who spoke about the situation in Korea, disclosing some facts not commonly known. Mr. Rider's discourse was humorous and, in turn, serious, exceedingly thought provoking, and was enthusiastically received by the audience.

The meeting was turned over to B. W. Farnes, who presented the new chapter officers to the members, and spoke briefly on their duties and responsibilities for the coming year. J. P. McDermott presented Past President Chewning with the traditional book ends. Attendance 68. Attendance ratio 0.41.

• *OREGON*—March 8, 1951. Pres. R. C. Chewning called the meeting to order at the Old Heathman Hotel and the minutes of the previous meeting were read and approved. President Chewning announced that full committee reports will be given at the May meeting, and called on E. R. Lokey for particulars on transportation to Seattle for the joint meeting with the Pacific Northwest Chapter on March 16. President Chewning introduced a number of guests and called on members to introduce their own guests, after which the meeting was turned over to H. W. McKenzie, meetings chairman.

Mr. McKenzie presented Walter Hanthorn, who acted as moderator of an oil burner discussion, and who introduced the members of the panel as follows: Messrs. Stover, DeVine, Obee, Steele and Anders. After a few opening remarks by Mr. Hanthorn, the members of the panel delivered their opening arguments on behalf of the particular phase of the subject with which they were concerned. According to Secretary Dick Blankenship's report, Mr. Stover led off with some low pressure remarks, Mr. DeVine was second with the high pressure side, Mr. Obee swung back to low pressure, Mr. Steele threw in a little oil and Mr. Anders stirred it up with some more high pressure.

Following a discussion from the floor, President Chewning announced the election of officers for 1951-52 as follows: *president*—H. W. McKenzie; *vice president*—K. H. Hanson; *secretary*—R. P. Lankow; *treasurer*—W. R. Pindell; and *board of governors*—R. C. Chewning, B. M. Thornburg, and Dick Blankenship. Attendance 75.

• *PHILADELPHIA*—April 12, 1951. Pres. J. W. McElgin called the meeting to order at 7:45 p.m. in the Engineers Club and the treasurer's report along with the report of the auditing committee were read and approved. The nominating committee report was read and a motion was made that the secretary cast a ballot unanimously electing the following officers for the year 1951-52: *president*—E. K. Wagner; *first vice president*—M. E. Barnard; *second vice president*—C. F. Dietz; *secretary*—A. M. Robertson; *treasurer*—L. M. Church; and an additional member of the *board of governors*—C. J. Lubking. This was followed by the introduction of the following new Chapter members: Frank Nagy, Warren Brewer, L. S. MacGann, K. W. Will, and D. A. Wick, Jr.

H. E. Degler, technical director, The Marley Co., Inc., Kansas City, Kan., was the speaker of the evening and spoke on the subject *Water Cooling Equipment for Refrigeration and Air Conditioning*. The talk was illustrated by slides and was followed by a lively discussion. Attendance 58.

• *PITTSBURGH*—April 14, 1951. Chapter members and their guests attended a luncheon in the new Terminal Building of the Greater Pittsburgh Airport as guests of McGinness, Smith & McGinness Co. Following lunch, Pres. A. F. Metzger called on W. D. Simpson, program chairman, to speak about the Chapter's annual meeting in May. Mr. Simpson also spoke about the *ASME* Conference to be held April 19-20, in which two Chapter members were taking part.

President Metzger then called on A. F. Nass, president of McGinness, Smith & McGinness, who spoke briefly about his company and stated that he was glad to have the Chapter members as his guests.

President Metzger introduced a few of the men responsible for the construction of the airport, and J. B. Sweeney, director, Department of Aviation, County of Allegheny spoke briefly. Mr. Sweeney spoke of when construction had begun and related many of the problems involved. T. F. Rockwell, consulting engineer from Pittsburgh, spoke about the heating, ventilating, and air conditioning systems installed in the building. After Mr. Rockwell's talk, the members and their guests were divided into groups of about 15 each, and taken on a tour throughout the Terminal Building. Attendance 135.

• *ROCKY MOUNTAIN*—March 7, 1951. L. E. Seeley, president of the Society and dean, College of Technology, University of New Hampshire, Durham, N.H., was the guest of honor at the Chapter's March 7 meeting, which was called to order by Pres. R. W. Petersen in the Town House Inn, Aurora, Colo. Dean Seeley, in speaking on *Engineering With a Human Touch*, stressed the importance of the human being as the subject to be considered in the design of heating and ventilating systems and equipment. Dean Seeley also spoke briefly on the activities of the Society and a vote of thanks was extended to him for his address.

The speaker of the evening was V. D. Wissmiller, supervisor, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., who spoke on *Electronic Controls*. Mr. Wissmiller outlined the history of electronics, covering its application to other accepted mechanical devices widely available to the American public, discussed the basic electrical physics underlying the electronic circuit, and explained how electronic circuits are applied to control applications. Mr. Wissmiller pointed out the inherent advantages of the electronic circuit emphasizing the sensitivity due to low mass and high amplification of signal strength, and, in general, the extreme simplicity of the sensing devices. He concluded with the observation that while electronic controls are not superior in all respects to existing electric and pneumatic systems, their advantages make them particularly applicable in certain control problems which the engineer should recognize. Attendance 98.

• *SOUTHERN CALIFORNIA*—April 18, 1951. Following dinner in the Carolina Pines Restaurant, Los Angeles, and a short coffee talk by Al Levine, design supervisor for Ralph E. Phillips, mechanical and electrical engineer of Los Angeles, Pres. L. J. Helms opened the business meeting. It was decided to dispense with the reading of the minutes and committee reports.

D. D. Wile, chief engineer, Refrigeration Engineering, Inc., Los Angeles, was the speaker of the evening. Mr. Wile's topic was *A New Development in Evaporative Condensers*. He explained the fundamental principles of evaporative condenser design and then gave a detailed account of the principles and function of a forced draft type evaporative condenser, having special features. The talk was illustrated with projector slides, which showed the principal differences between this design and the conventional induced draft type unit. The talk was well received and was followed by an interesting question and answer period.

Following a few announcements concerning the Semi-Annual Meeting in July, the movie on Portland, encouraging attendance at the Meeting, was shown. Attendance 98. Attendance ratio 0.37.

• *SOUTHERN CALIFORNIA*—March 21, 1951. Pres. L. J. Helms, called the meeting to order at 8:00 p.m., following dinner in the Carolina Pines Plantation Room, Los Angeles. The reading of the minutes and chapter committee reports was dispensed with.

R. C. Cushing, regional sales manager, Commercial Division, Minneapolis-Honeywell Regulator Co., San Francisco, Calif., was the speaker of the evening. Mr. Cushing's talk was on *Electronics for Heating and Air Conditioning* and covered some interesting phases of late developments in this modern field of control, showing results of operation as well as application of the newer type of electronic control apparatus. Attendance 89. Attendance ratio 0.35.

• *SOUTHWEST TEXAS*—March 20, 1951. Members and guests met in the Tapestry Room of the St. Anthony Hotel, San Antonio, Tex., and the minutes of the previous meeting were read and approved. Vice Pres. W. E. Long made a complete report on the Society's recent 57th Annual Meeting in Philadelphia, speaking in particular on the activities of the Chapters Conference Committee. The moving picture on the Portland Meeting was shown for the purpose of encouraging large membership attendance at the Society's forthcoming Semi-Annual Meeting.

Pres. I. W. Wilke introduced the speaker of the evening, Martin Wukasch, industrial hygiene engineer with the State Department of Public Health, Austin. Mr. Wukasch revealed that the State Department of Public Health can give advice only on ventilation, sanitation, and metal fumes in the prevention of carbon monoxide poisoning. It does not have the power of authority, the State Department of Labor being the only agency of enforcement. He stated that there is a lot of educational work being done on exhaust and fume hoods, in particular, since there is not much general knowledge among sheet metal workers on this subject. A very interesting movie was shown, which was filmed by the University of Michigan, picturing various types of exhaust hoods to improve the health of industrial workers. Attendance 28. Attendance ratio 0.28.

• *UTAH*—March 15, 1951. Vice Pres. A. R. Curtis, presiding officer in the absence of Pres. R. H. East, called the meeting to order at 7:00 p.m. in the Doll House. The minutes of the January 11 meeting were read and approved and a motion was passed accepting Pres. L. E. Seeley's offer to speak at the Chapter's May 2 meeting. Vice President Curtis appointed the nominating committee as follows: C. H. Spencer, W. L. Stuewe, and M. L. Gollaher.

The speaker of the evening was E. D. Smith, vice president and manager, Machinery Division, The Lang Co., Inc., Salt Lake City, Utah. Mr. Smith spoke about the installation of an ice cream freezing tunnel at the local plant of the Colville Ice Cream Co. He said that the design of the tunnel was based on tests made in a vegetable freezing tunnel and the experience gained in talking to owners of some existing tunnels. The tunnel was designed to freeze 500 gal of ice cream per hour plus 200 dozen novelties. Mr. Smith showed slides and illustrated the talk with the use of a blackboard, and touched on the many problems involved. Attendance 14.

• *WASHINGTON, D. C.*—April 11, 1951. Members and guests met in Naylor's Seafood Restaurant and the meeting was called to order by Pres. F. M. Thuney at 8:25 p.m. The election of 1951-52 officers was held with the following results: *president*—S. R. Allen; *vice president*—G. R. Walz; *secretary*—P. H. Loughran, Jr.; *treasurer*—J. L. Manheim; and *board of governors*—F. M. Thuney, I. M. Bortman, and Rutcher Skagerberg.

The speaker of the evening was H. K. Kugel, chief engineer, Smoke Regulation and Boiler Department of the District of Columbia. Mr. Kugel began by stating that it was 13 years since he had spoken to the Washington, D.C., Chapter and that he intended relating what had been accomplished by his department since that time. Mr. Kugel stated that after many complaints had been received about the smoke conditions in the city a new law was passed with the help of the late Senator R. S. Copeland, who was at one time Health Commissioner of New York City. He continued relating the work done by the department and concluded his talk by stating that he did not mean to give the impression that he had done a perfect job but that he had made an appreciable inroad in the job of cleaning up the nation's capital. Attendance 50. Attendance ratio 0.40.

• *WESTERN NEW YORK*—April 9, 1951. Pres. J. H. Bryce called the meeting to order at 7:50 p.m. and members introduced themselves and their guests. The minutes of the March meeting were read and approved and M. C. Beman, member of the chapter's board of governors, spoke to the Chapter on the purpose and the duties of members of the Society's Council. Mr. Beman then proceeded to announce the creation of a new chapter office, that of assistant treasurer, and Roswell Farnham reported on the nomination of officers for 1951-52.

The speaker of the evening was R. E. Holmes, chief engineer of the Air Conditioning and Refrigeration Division of the Worthington Pump and Machinery Corp. Mr. Holmes spoke on *Present Trends in Present Air Conditioning and Equipment*, and used slides to illustrate the many problems of design and application. A discussion period followed the talk. Attendance 38.

• *WISCONSIN*—March 19, 1951. Members' wives and their guests were especially invited to this meeting, which was held at the University Club and called to order by Pres. F. J. Nunlist at 8:00 p.m. H. F. Brinen, program chairman, spoke about the April and May meetings, and President Nunlist appointed a nominating committee for the selection of 1951-52 officers as follows: B. M. Kluge, chairman, A. S. Krenz, and F. W. Goldsmith. President Nunlist commended the membership committee for the excellent job it had done in obtaining 28 new chapter members since last June, and introduced two new chapter members, T. R. Christy and G. R. Gibson. A short sound film *There's More Than Meets the Eye* was shown, which indicated the technical aspects of presenting a television program.

Mr. Brinen introduced the speaker of the evening, Dr. Clifford H. Kalb, who gave an address on *Children's Allergies*. Dr. Kalb stated that although allergies are of ancient origin, only within recent times has considerable research or progress been accomplished. He said that allergic materials can be in the form of foods, with specific reference to eggs, milk and fish, medical prod-

ucts, such as oil from fish livers, and skin contact with certain materials, such as kapok, ragweed, turpentine, animal fur and cloths. He added that emotional characteristics are important in a subject's reaction to allergic materials and that tests have been developed to determine the sensitivity of a person to most of the known allergic materials. After an interesting discussion period, the meeting was adjourned with a vote of thanks to Dr. Kalb. Attendance 63. Attendance ratio 0.20.

STUDENT BRANCHES

• *NORTH CAROLINA STATE COLLEGE*—March 13, 1951. Pres. L. R. Wensil opened the meeting at 7:00 p.m. in Page Hall of the College, and the minutes of the previous meeting were read and approved. President Wensil then welcomed Professor Reed and the student delegation from Duke University, Durham, N.C. to the meeting.

W. H. Shinn introduced the speaker of the evening, J. E. Hart, partner in the consulting engineering firm of Watson & Hart, Greensboro, N.C., who spoke on *The Heating Requirements of Public Schools.* Attendance 26.

• *OKLAHOMA A. & M. COLLEGE*—March 15, 1951. The first order of business following the opening of the meeting was the introduction of the guest speaker of the evening, W. C. Gilpin, Jr., sales engineer, Frigidaire Division, General Motors Corp., Oklahoma City, Okla. Mr. Gilpin, a graduate of Oklahoma A. & M., gave an interesting talk on what is expected of an engineer fresh out of college.

The students that attended the March 12 meeting of the Oklahoma Chapter gave brief reports of the activities at the meeting and the group chosen to attend the Chapter's April 9 meeting consisted of: Messrs. Brynie, Carr, Crooks, Loosley, and Cohen.

W. E. Suchan, Jr. proposed having a dinner meeting commemorating the charter presentation anniversary. The proposal was approved and Pres. R. F. Mossman appointed Mr. Suchan to send letters inviting members of the Oklahoma and Northeastern Oklahoma Chapters and past members of the Student Branch to the meeting. Attendance 16. Attendance ratio 0.82.

• *PURDUE UNIVERSITY*—March 20, 1951. Stanley Kalfus, chairman of the Student Branch, called the meeting to order at 7:00 p.m. in the Mechanical Engineering Building of the University. The minutes of the previous meeting were read and approved. This was followed by a progress report by the various committees which are undertaking projects to display during *Open House.* One group is going to operate the two refrigeration units contained in the University's lab; another group is building a typical composite wall section to demonstrate how the heating and ventilating engineer calculates the heat loss in a room; a third group is going to demonstrate the control of moisture in domestic heating with the use of glass models.

The meeting was then turned over to W. S. Harris, special research associate professor, Department of Mechanical Engineering, University of Illinois, Urbana, Ill., who spoke on *Hot Water Heating Systems Used in Domestic Building.* Professor Harris' talk was accompanied by slides. Attendance 19. Attendance ratio 0.93.

• *TEXAS A. & M. COLLEGE*—March 13, 1951. The meeting was called to order by Pres. J. O. Kadel at 7:30 p.m. in the Mechanical Engineering Lecture Room of the College. Following self introductions of everyone present, the minutes of the previous meeting were read and approved as read.

Vice Pres. J. B. Banowsky introduced the speaker of the evening, W. D. Scoates of the College's Engineering Experiment Station, who gave a very interesting talk on *Design and Testing of Fans.* Attendance 14. Attendance ratio 0.53.

• *UNIVERSITY OF TEXAS*—March 27, 1951. Pres. W. A. Cox called the meeting to order at 7:00 p.m. and the minutes of the previous meeting were read by R. M. Tittle, in the absence of the secretary. V. H. Miles was elected secretary to replace M. F. Klevar.

Prof. W. E. Long introduced Mr. Luedecke, the speaker of the evening, to the Student Branch. Mr. Luedecke spoke on *Opportunities for Young Engineers in the Heating & Air Conditioning Field,* and following his talk answered many questions asked by the students regarding the profession. Attendance 11.

ASRE HOLDS SPRING MEET

Refrigeration engineers from throughout the United States gathered in Detroit's Statler Hotel, May 27 through 30, for the 38th Spring Meeting of the *American Society of Refrigerating Engineers.* In addition to learning the latest in refrigeration techniques, the group was addressed on the situation regarding shortages of critical materials so necessary in the manufacture of refrigeration equipment.

F. PAUL ANDERSON AWARD

The Committee of Award for the F. Paul Anderson Medal invites the members of the ASHVE to nominate members of the Society whose notable scientific achievement or outstanding services performed in the field of heating, ventilating or air conditioning should receive recognition.

The Committee should receive nominations with a statement of the candidates' achievements prior to August 1, 1951.

ERNEST SZEKELY, *Chairman*
F. PAUL ANDERSON COMMITTEE

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month 100 applications for membership, including 23 student applications; and 12 advancements have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by June 29, 1951, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

ALLEN, J. E., Partner, A. J. Allen Plumbing & Heating, Des Moines, Ia. REFERENCES: B. E. Landes, D. C. Murphy, R. H. Schnell, B. A. Schwirtz.

ATKINSON, W. G., Proprietor, Ellesmere Engineering Co., Walkden, England. REFERENCES: W. S. Holt*, C. G. Huntley*, R. R. Jennings*, Walter Yates.

AXELROD, ABRAHAM, Designer-Draftsman, Parsons, Brinckerhoff, Hall & Macdonald, Inc., New York, N. Y. REFERENCES: S. R. Apt, E. B. Johnson, Joseph Siegel, Irwin Smith.

BAIN, J. R., Sales Engr., Minneapolis-Honeywell Regulator Co., Des Moines, Ia. REFERENCES: B. E. Landes, D. C. Murphy, D. B. Stevenson, Jr., R. S. Stover.

BALL, G. F., Partner, Central Plumbing & Heating Service, Des Moines, Ia. REFERENCES: B. E. Landes, R. L. Pound, R. H. Schnell, B. A. Schwirtz.

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DENHAM, F. R., Mech. Engr., Carnahan & Thompson Engineers, Oklahoma City, Okla. REFERENCES: J. H. Carnahan, J. R. Patten, H. S. Shafer, R. E. Swan.

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ANDERSON, C. C.
McHARDY, P. M.

UNIVERSITY OF WISCONSIN, Madison, Wis. CERTIFIED BY: D. W. Nelson.
BRUNS, E. G.

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OBITUARIES

WILLIAM H. BALLMAN
Baltimore, Md.

William H. Ballman, a member of the Baltimore Chapter of ASHVE, died March 18, 1951 in Baltimore, Md. Born in Maryland on February 5, 1900, Mr. Ballman graduated from Florida University of Technology in 1921 with a degree in mechanical engineering.

Some of the firms with which he was associated during his career were Nash-Kelvinator Corp., New York, N.Y., Westinghouse Electric and Manufacturing Co., Philadelphia, Pa., and the William P. McDonald Corp., Davenport, Fla. Mr. Ballman was a member of the Society for 14 years.

The Officers and Council of the Society extend their sincere sympathy.

F. RUSSELL BICHOWSKY
Oakland, Calif.

Dr. F. R. Bichowsky, recognized as one of the foremost physical chemists in the country and author of a number of books and papers in that field, died in California, April 4, 1951, as a result of injuries suffered in an automobile accident, early in 1950.

Born at San Gabriel, Calif., on February 19, 1889, Dr. Bichowsky was graduated from Pomona College in 1912 with an A.B. degree and subsequently received M.S. and Ph. D. degrees from the University of California. He continued his education for one year at Harvard University.

Dr. Bichowsky began his career in 1916 as a physical chemist in the National Geophysical Laboratory, Washington, D.C., remaining in that position until 1919 when he became an associate professor on low temperature research and thermo-chemistry at the University of California, Berkeley, Calif.

In 1923, he was appointed associate editor of International Critical Tables, and remained in that post until 1924 when he became an associate professor at Johns-Hopkins University, Baltimore, Md., teaching and conducting research on thermodynamics.

From 1927 to 1934, he served in the capacity of inventor, consultant, and development engineer for the Frigidaire Division of the General Motors Corp., Dayton, Ohio, on do-

mestic refrigeration, commercial and industrial air conditioning and refrigeration, and ventilation and air conditioning for ships. Concurrently, he was superintendent of the Naval Research Laboratory, Washington, D.C.

In the years from 1935 to 1941, he did inventing, consulting, and development engineering work for such firms as Surface Combustion Corp., Toledo, Ohio, and Dow Chemical Corp., Ann Arbor, Mich. In 1940, he became president and partner in the firm of Bichowsky and Rice, River Forest, Ill.

During the war, Dr. Bichowsky served with the Eighth Army Bomber Command in Europe as official observer and performed the same function at the Bikini atomic bomb tests after the war.

In 1947, he returned to the University of California in the mechanical engineering division and was serving there when he was called to Washington to become a member of the Research Staff of the Operational Research Office of the Army under the supervision of Johns-Hopkins University.

Dr. Bichowsky was extremely active in Society work for many years and from 1936 to 1942 he served on the TAC on Psychrometry, acting as its chairman during four of those years. In 1939, '40, and '41, he served on the TAC on Instruments. In 1941, he served as chairman on the TAC on Sorbents, and in 1942 served on the TAC on Comfort Requirements for Summer Cooling.

The Officers and Council of the Society extend their sympathy to his wife, Helen, and his two daughters, Catherine and Barbara.

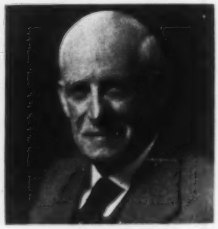
JOHN S. WEBB
Needham, Mass.

John S. Webb, Needham, Mass., died January 8, 1951. He was born in Gardiner, Me., January 7, 1888, and spent his entire career in managerial, consulting, or sales phases of power, heating and ventilating work. Firms with which he was associated included Wiley & Calhoun, Portland, Me., the Herman Nelson Corp., Boston, Mass., and Webster-Tallmadge Co., Inc., New York, N. Y. At the time of his death he was a partner in the firm of Webb and Wilkinson, Boston.

The Officers and Council of the Society extend their sympathy.

JOSEPH G. HAYES
Indianapolis, Ind.

Joseph G. Hayes, nationally known in the plumbing and heating industry and a Life Member of the Society since 1937, died at his winter home in Miami, Fla., April 24. He was 83.



Joseph G. Hayes
Indianapolis, Ind.

Born in Hamilton County, Ohio, Mr. Hayes received his early education in Indianapolis, Ind., and later went to New York City to study plumbing and heating. A resident of Indianapolis since 1900, he joined with his two brothers, the late Frank J. and Clinton T. Hayes, that same year in forming the Hayes Bros. Co., of which he was active head. Following the death of Frank in 1919, Mr. Hayes became president of the company.

Mr. Hayes was commissioner of Marion County from 1914 to 1919 and was extremely interested in highway improvement, being responsible for the widening of U.S. 40 leading into Indianapolis. During his term in office, more than 100 miles of hard surface roads were constructed in the area. He also was one of the founders of the Marion County Tuberculosis Hospital at Sunnyside, Indiana.

In addition to his outstanding and tireless work in the public interest, Mr. Hayes, or "Uncle Joe" as he was affectionately known, was a friend nationally of organized labor and served on many national committees connected with the plumbing and heating industry. In an editorial commenting on his career, the *Indianapolis News* stated, *A man of high principles, integrity, and firm friendships, Mr. Hayes served his business and the public with equal fidelity.*

Mr. Hayes was extremely proud of the development of the Hayes Company from its modest beginning to its place as one of the largest in the field. As was the case with all with whom he came in contact, he was held in high esteem by his employees. On the occasion of Mr. Hayes' 80th birthday a few years ago, Clarence N. Warren, vice president of the Hayes Co., said—*Your employees, dating back to 1905, form a chain that links 42 years service with you. That's a long chain, nearly ninety percent of the total years Hayes Bros. has been in business. That speaks for itself, probably the greatest compliment we can give you. You have that precious attribute of leadership and friendliness along with it that creates longevity of service around this little family of fellow workers.*

Mr. Hayes was one of the organizers of the Indianapolis Chapter. In 1943 and 1944, he served as alternate representative for the Indianapolis Chapter on the Society's Nominating Committee. He was also past president and honorary director of the *Indiana Association of Master Plumbers*, a member of the Columbia Club, Scientech Club, Marion Masonic Lodge, Knights Templar, Scottish Rite and Shrine.

He was long a member of the *National Association of Master Plumbers* and the *Heating, Piping and Air Conditioning Contractors National Association.*

He is survived by his two sons, Grant J. and Clinton F. Hayes; his daughter, Mrs. Sue Adams; two grandchildren; and two great-grandchildren. The Officers and Council of the Society extend their sympathy.

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● **UTAH:** Organized 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. PRESIDENT, R. H. East, 1086 E. 21st St., Salt Lake City. SECRETARY, D. R. Wilde, 204 Dooly Bldg., Salt Lake City 1.

● **VIRGINIA:** Organized 1946. Headquarters, Norfolk, Va. Meets Third Wednesday. PRESIDENT, J. F. Boyenton, 400 W. 24 St., Norfolk 8. SECRETARY, J. E. Harding, Apt. R-2, St. James Terrace, Newport News.

● **WASHINGTON, D. C.:** Organized 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. PRESIDENT, S. R. Allen, 942 Washington Bldg., Washington 5. SECRETARY, P. H. Loughran, Jr., 4513 49th St., N.W., Washington 16.

● **WESTERN MICHIGAN:** Organized 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, K. E. Robinson, 211 Smith Ave., Lansing 10. SECRETARY, F. W. Brundage, 512 N. Park St., Kalamazoo 11.

● **WESTERN NEW YORK:** Organized 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. PRESIDENT, T. F. Killeen, 371 Delaware Ave., Buffalo 2. SECRETARY, R. E. Lang, 140 Meadow Lane, Kenmore 23.

● **WISCONSIN:** Organized 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. PRESIDENT, H. F. Brinen, 226 Kenzie Ave., Racine. SECRETARY, L. C. Plaehn, 914 N. Broadway, Milwaukee.

Student Branches

● **COLLEGE OF CITY OF NEW YORK:** Organized 1949. Headquarters, New York, N. Y. PRESIDENT, Seymour Weinberg, 2147 72nd Street, Brooklyn 4. SECRETARY, Benjamin Karp, 524 Berriman St., Brooklyn 8.

● **LOUISIANA POLYTECHNIC INSTITUTE:** Organized 1949. Headquarters, Ruston, La. PRESIDENT, W. G. McMullen, Box 472, Tech Station, Ruston. SECRETARY, R. L. Gorton, Box 184, Tech Station, Ruston.

● **NORTH CAROLINA STATE COLLEGE:** Organized 1948. Headquarters, Raleigh, N. C. PRESIDENT, L. R. Wensil, 409 N. Church St., Concord. SECRETARY, F. T. Lathers, 314 Hillsboro St., Raleigh.

● **OKLAHOMA A. & M. COLLEGE:** Organized 1950. Headquarters, Stillwater, Okla. PRESIDENT, R. F. Mossman, 5 Belvoir, Vet Village, Stillwater. SECRETARY, G. J. Martinez, 410 West Elm, Stillwater.

● **OREGON STATE COLLEGE:** Organized 1949. Headquarters, Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. J. Kemper, Jr., 645 N. 4th, Corvallis. SECRETARY, J. M. Templer, 720 Kings Rd., Corvallis.

● **PURDUE UNIVERSITY:** Organized 1948. Headquarters, W. Lafayette, Ind. CHAIRMAN, Stanley Kalfus, Purdue University, Seneca Dormitory, W. Lafayette. SECRETARY, Miss June Cox, 403 Maple, W. Lafayette, Ind.

● **TEXAS A. & M. COLLEGE:** Organized 1946. Headquarters, College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054, College Station, Tex. SECRETARY, W. C. Haggard, Box 5227, College Station.

● **UNIVERSITY OF DETROIT:** Organized 1949. Headquarters, Detroit, Mich. Meets, First Tuesday. PRESIDENT, L. M. Blanchette, 2245 Holcomb, Detroit 14. SECRETARY, S. H. Kosinski, 4439-30th, Detroit 10.

● **UNIVERSITY OF KANSAS:** Organized 1949. Headquarters, Lawrence, Kans. PRESIDENT, J. L. Williams, 1200 Mississippi, Lawrence, Kans. SECRETARY, R. C. Umholtz, 2732 Michigan St., Topeka, Kans.

● **UNIVERSITY OF TEXAS:** Organized 1949. Headquarters, Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, W. A. Cox, 360-D Deep Eddy Apts., Austin. SECRETARY, V. H. Miles, PHP Dorm J, Austin.

● **UNIVERSITY OF TORONTO:** Organized 1951. Headquarters, Toronto, Ont. CHAIRMAN, H. F. Spragg, 55 Harrison Ave., Aurora, Ont. SECRETARY, J. E. G. Blaiklock, 23 Isabella St., Toronto 5, Ont.

Replace This Renewable Disc Easily, Quickly...

On Your LUNKENHEIMER 'N-M-D' Valves

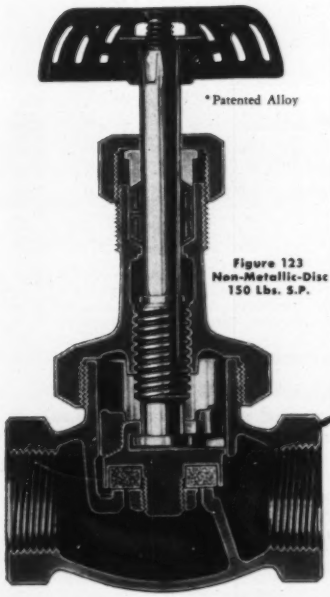


Figure 123
Non-Metallic-Disc
150 Lbs. S.P.

Hold your maintenance costs down with Lunkenheimer Non-Metallic-Disc valves for handling steam, hot water, cold water, air and gas, gasoline, and many other fluids.

We will recommend the *right* disc for your *specific* service — and show you how Lunkenheimer "N-M-D" valves give you maximum wear and tightness . . . at far less maintenance cost. The disc holder of Figure 123 is a simple slip-on type. Just slide it off the stem, remove the locknut — and switch discs. Reassemble with the new disc in place, and your valve is good as new. Four long guides assure perfect seating . . . prevent "cocking" of the disc.

Lunkenheimer "N-M-D" valves have the amazing new Stemalloy* stem, which has actually been tested at more than 300,000 openings and closings, with live steam flowing through the lines. Millions are in use — without a single wear failure.

Ask your Lunkenheimer distributor about the dozens of other features that make "N-M-D" valves your best buy for composition-disc service. And *write for your copy of Circular 558* to The Lunkenheimer Company, Box 360N, Cincinnati 14, Ohio.

BRONZE • IRON • STEEL

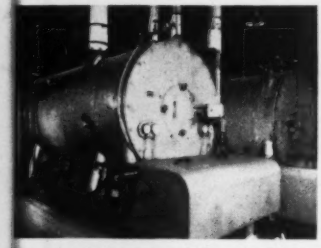
LUNKENHEIMER
THE ONE *Great* NAME IN VALVES

Steam Generators Pay for Selves and Save $10,000 in First Year

Operating Costs Reduced Sixty-Six % With Lower Fuel Cost & Maintenance

Many railroads have effected huge savings by replacing old inefficient boilers with modern packaged automatic steam generators. Mr. O. T. Carroll, Chief Engineer of Peoria & Pekin Union Railway Co., Peoria, Ill., purchased for his company two modern packaged steam generators; a 75 h.p. for stand-by and a 150 h.p. "on-the-line", and reports his savings as follows:

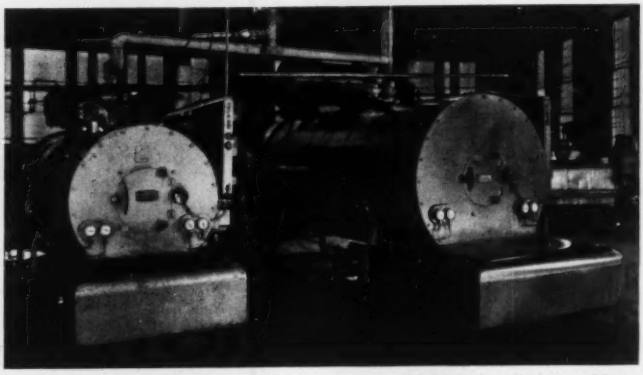
"The operation of the two York-Shipley Steam-Pak Generators installed in our roundhouse to furnish steam for heating the roundhouse and offices is beyond our expectations as to expense and efficiency. The savings effected in changing from the operation of the old coal-fired boiler will pay for the cost of installation and the first year's operation."



The total investment for these two new generators, fired with low cost Bunker C heavy fuel oil, was approximately $35,000.00. Cost of fuel and maintenance annually was reduced to approximately $8,000.00—a 66% reduction, based on the average operating cost of the old plant of $53,000.00 per year.

Maintenance cost old boiler	$53,000.
Cost of new equipment	35,000.
Operating cost new equipment	8,000.
Total cost first year	$43,000.
First year's savings	$10,000.
Estimated 2nd. year savings	$45,000.

These modern Steam-Pak Generators, manufactured by York-Shipley, Inc., York, Pa., are showing similar savings in hundreds of installations all over the country.



Multiple installation at Monon Railroad, Indianapolis, saves $1,000.00 per month in fuel and labor.

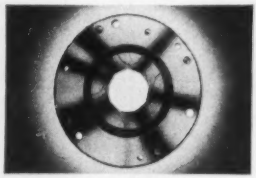
STEAM-PAK YORK 95 POWER GENERATOR
A PRODUCT OF YORK-SHIPLEY

SAVE MONEY

They're Built For Maximum Efficiencies In Operation . . .

- Engineering design recognized by top engineers and architects.
- Satisfactory operation in thousands of buildings all over the country.
- Tremendous savings proven by hundreds of case histories.
- Distributors chosen for their engineering ability, trained to provide the best engineering "know-how."

These are four basic reasons why Steam-Pak should be No. 1 on your list of steam generators.
See your nearest York-Power Distributor or write York-Shipley for complete details.

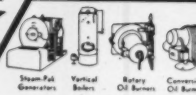


IRIS SHUTTER
Patent protected feature provides precision control of burner air, accurately synchronizing air-oil adjustment.

NEW FIRE CONTROL
Swirling flame action speeds gas flow, increasing heat absorption and combustion efficiencies.

Steam-Pak Generators — from 15 h.p. up, for low or high pressure steam or hot water, for light or heavy oil, combination gas and oil or straight gas.

YORK SHIPLEY
634 JESSOP PLACE · YORK, PENNSYLVANIA · PHONE 7861
Industrial Division



INDUSTRIAL DIVISION
COMMERCIAL DIVISION
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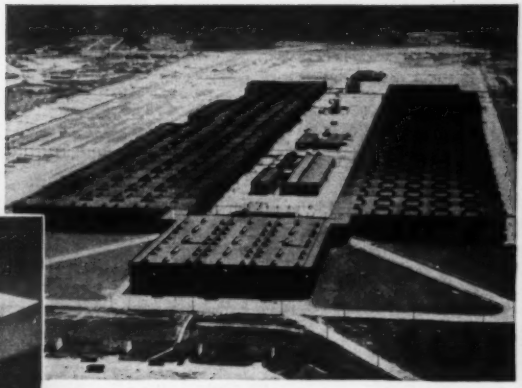
kno·draft
adjustable air diffusers



for
air conditioning
efficiency
at Oak Ridge

Atomic energy plant at Oak Ridge, Tennessee, with detail of typical Kno-Draft *Adjustable* Air Diffuser.
Architects and Engineers: Skidmore, Owings, and Merrill.

Precise efficiency governs all operations at the U.S. Atomic Energy Commission's Oak Ridge plant. So distribution of conditioned air is through Kno-Draft *Adjustable* Air Diffusers—chosen because they circulate the air gently, *without drafts* . . . assure thorough, instantaneous mixing to maintain an even temperature throughout the conditioned area.

Also, Kno-Draft *Adjustable* Air Diffusers permit accurate control of air volume and direction *after* installation. This simplifies preliminary engineering and permits easily made changes to meet altered conditions—an important consideration.

Efficiency governed the choice of Kno-Draft at Oak Ridge. But for many installations, beauty is a first consideration. Kno-Draft *Adjustable* Air Diffusers have this, too . . . the quiet simplicity that fits unobtrusively into any surroundings. There are types and sizes to meet every requirement.

KNO-DRAFT DATA BOOK: Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

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Air Diffusion • Air Purification • Air Recovery
In Canada: Douglas Engineering Co., Ltd.,
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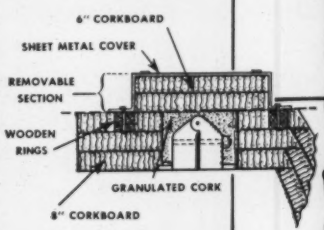
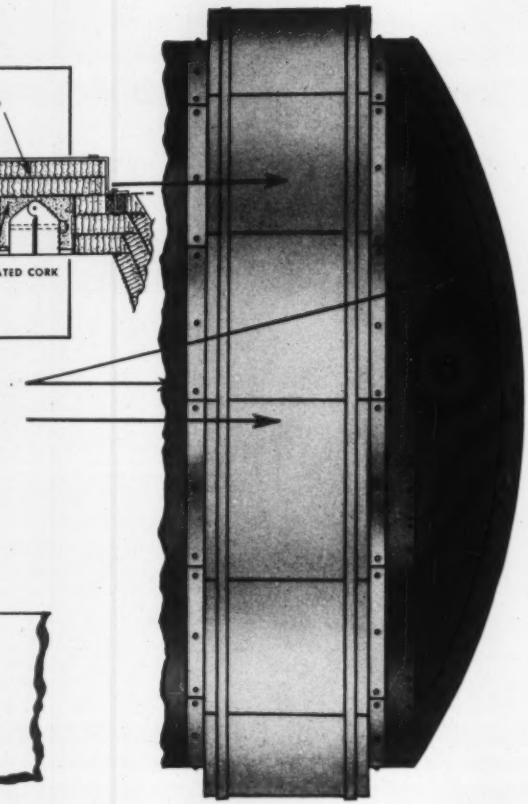
W. B. CONNOR ENGINEERING CORP.
Dept. G-61, Danbury, Connecticut
Please send me, without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

Name .....
Position .....
Company .....
Street .....
City ..... **Zone** ..... **State** .....

Diagrammatic view of insulation on removable head of continuous filter maintaining temperatures as low as 70° below zero. Head is insulated with Armstrong's Corkboard, 8" thick, protected with sheet metal. Tank body insulated with 8" corkboard finished with Armstrong's Asphalt Emulsion. Removable flange sections are made up of 2 layers of Armstrong's Corkboard, each 3" thick. Each section is covered with sheet metal and bolted to wood rings.





We have been asked . . .

"What's the best way to insulate a removable tank head?"

"I want to insulate the removable head of a low-temperature filter tank," writes a plant engineer. "How can this be done so that the tank head can be taken off during cleaning without damaging the insulation."

To help maintain correct internal temperatures, we advised that Armstrong's Corkboard in the proper thickness be applied to both the tank body and head in hot asphalt or adhesive, and banded in place. To make the insulation removable over the flanges, it should be fastened on mechanically instead of with an adhesive. As illustrated in the drawing above, curved segments of Armstrong's Corkboard are built up and fitted around the flange. Each segment is covered with sheet metal for extra protection and easy removal. When they're bolted and banded on, the segments fit tightly, keeping heat away from the cold flanges and preventing condensation and frost damage.

SEND US YOUR QUESTIONS: If you have any questions involving the use or application of low-temperature or heat insulation, do not hesitate to call on us. We'll see that you get a practical answer. Just address a letter or post card to Armstrong Cork Company, 4406 Concord Street, Lancaster, Pennsylvania.

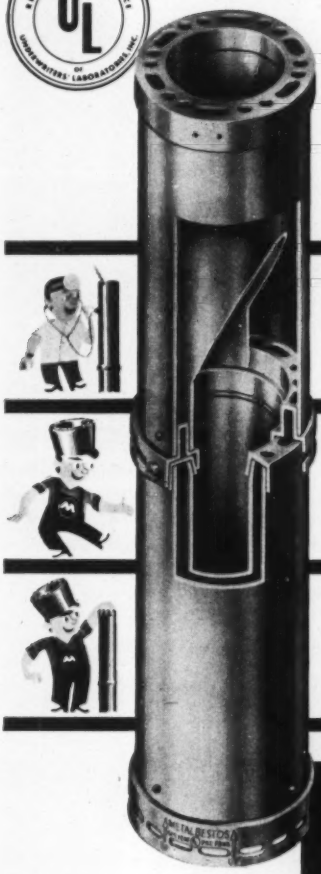
ARMSTRONG'S INDUSTRIAL INSULATIONS

GREATEST
VENTING PROTECTION

LOWEST
INSTALLATION COST

*you get **both** when you use*

QC METALBESTOS
GAS VENT



Safe, Efficient Operation

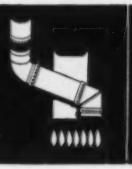
Metalbestos' all-aluminum, double wall construction provides maximum insulation and permanently gastight joints eliminate the possibility of fire hazards or leakage of fumes. Independent laboratory tests prove that Metalbestos keeps surrounding walls cooler than any other Type B gas vent listed by Underwriters' Laboratories, Inc.

Durable Construction

Made from a high grade aluminum alloy, Metalbestos will not deteriorate from the effects of weather, corrosive flue gases or condensates. Breakage during handling, storing or installation is eliminated because this sturdy, all-metal gas vent will not crack or shatter.

Simple Installation

Metalbestos is easily and quickly assembled. Precision made QC couplers automatically align pipe sections and form leak-proof joints. Adjustable lengths and all-purpose fittings eliminate expensive cutting and fitting. No cement, mastic or banding material is required — no special tools are needed.



METALBESTOS DIVISION

WILLIAM WALLACE COMPANY · BELMONT, CALIF.

SEND FOR FREE VENTING MANUAL

A new manual, "Venting of Gas Appliances," is now ready for distribution. Published in the interests of better venting, this valuable booklet contains the important rules for venting gas appliances and other helpful information concerning good venting practices. Yours without charge — simply fill out coupon. No obligation.

METALBESTOS Division, Dept. N William Wallace Co.
Belmont, California
Please send a copy of your new manual, "Venting of Gas Appliances."

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COMPANY _____

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CITY _____ ZONE _____ STATE _____

Westinghouse Air Conditioning by: Lloyd E. Mitchell, Inc., Baltimore, Md.

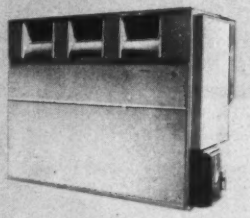
COOL AIR SOLVES A CORKING PROBLEM

Over and over, down a 50-foot revolving cylinder, millions of adhesive-coated cork particles cascade through chilled air. Warm and sticky, these particles could gum up the works in nothing flat. But cooled, they flow like salt from a shaker into machines that produce the familiar disc found the world over in beverage bottle caps.

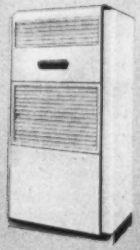
Westinghouse Air Conditioning helps Crown Cork & Seal here . . . also solves cork storage problems involving temperature and humidity control . . . adds a dividend by increasing employe efficiency in packing rooms.

Westinghouse can *put air to work* for you, too . . . with air conditioning, air handling and air cleaning equipment. Call the Westinghouse Air Conditioning Distributor in the classified directory, or write Westinghouse Electric Corp., Air Conditioning Division, Hyde Park, Boston 36, Mass.

Westinghouse hermetically-sealed air conditioning compressors . . . dependable under all conditions. Dirt and dust sealed OUT, oil and refrigerant sealed IN. 2 to 100 ton capacities.



A full line of factory-assembled air conditioners for installation outside the space. 10, 15, 20 and 25 ton capacities.



UNITAIRE® CONDITIONERS . . . a self-contained system in one attractive cabinet for office or small commercial installations. 2, 3, 5 and 8 ton capacities.

YOU CAN BE SURE...IF IT'S

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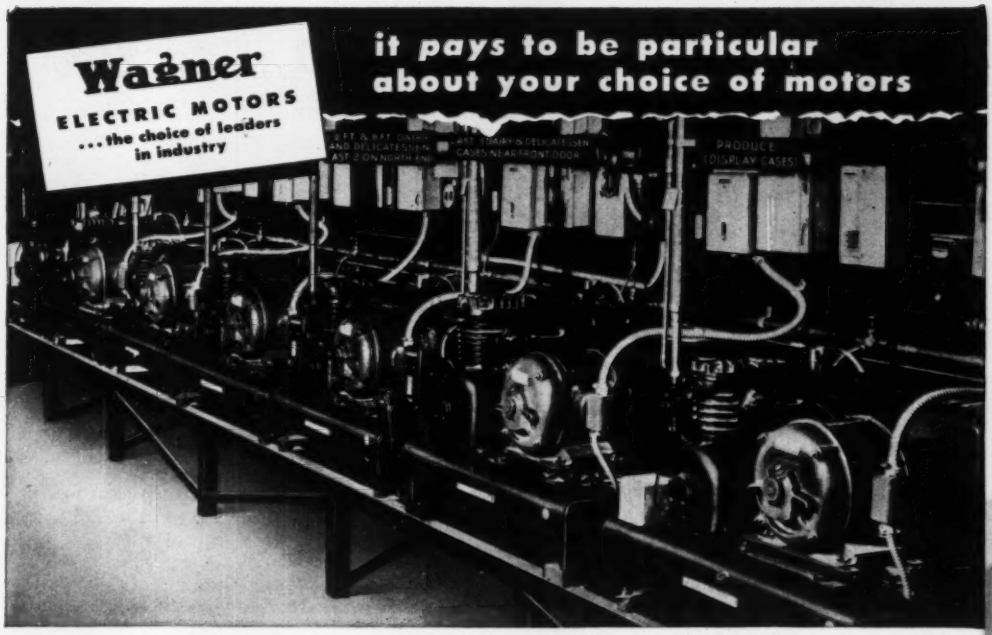
ELECTRIC MOTORS
... the choice of leaders in industry

it *pays* to be particular about your choice of motors



Wagner Capacitor-Start Motors—⅛ to 3 hp.

Wagner Repulsion-Start Induction Motors—⅛ to 15 hp.

you can count on

Wagner MOTORS

to furnish dependable power for your products

"A good motor is one I seldom hear about—and a good motor manufacturer is one who provides prompt honest service for the few motors I do hear about." These words, from the Service Manager of one of the large manufacturers who use thousands of Wagner Motors each year as standard equipment for their products, pretty well sum up the reasons why it will pay *you* to standardize on Wagner Motors.

You get motors that give uniform performance with exceptionally little trouble ... you get well-known motors that add a real selling point to your product ... and you get the advantage of a large nationwide service organization to promptly and efficiently repair the very few motors that require attention.

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

® Wagner Electric Corporation 1891 WE 1951

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a lot of eyebrows raised when this one came along

Yes . . . when the Motorpump hit the market it stirred up a lot of surprise and enthusiasm among people in air conditioning. They saw that Ingersoll-Rand engineers had developed a different, *smaller* pump that was higher in efficiency and reliability when compared *size* for *size* with *any* type pump on air conditioning systems today!

Immediately, such a pump gave people like yourself, in air conditioning, many advantages. In the first place, the smaller pump costs less. There are savings in weight, space and power consumption. Most important, installations would be far less expensive.

The proof is yours when *you* put I-R Motorpumps to work. You can get prompt delivery from any one of many I-R branch warehouses. Call your nearest I-R distributor or representative for any facts or figures, or write direct for our descriptive booklet "A Picture of Improved Pumps for Air Conditioning". Ingersoll-Rand Company, 11 Broadway, New York 4, New York.

Ingersoll-Rand

90 years of BIG PUMP know-how packed into small pumps for air conditioning applications

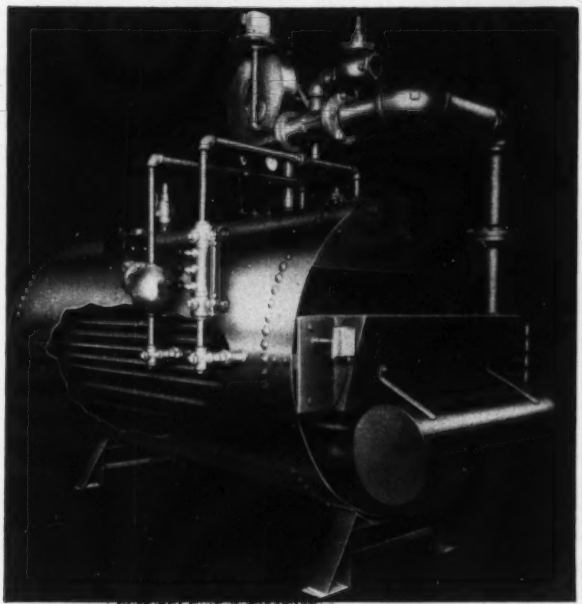
MOTORPUMP

Sellers

ECONOMY
EFFICIENCY
DEPENDABILITY
SAFETY

ALL THIS—
and

PROMPT DELIVERY TOO!



By careful advance planning Sellers was able to anticipate the present period of shortages and provide materials and productive capacity to assure prompt delivery of this popular boiler.

Place your order now while you can be assured of getting your Sellers Immersion Steam Boiler, Model 46, when you want it. Don't delay until the increasing impact of war production orders makes delivery uncertain or well nigh impossible.

Remember, whether you require steam for heating or process purposes or need a stand-by boiler unit for peak loads, only the Sellers Immersion Steam Boiler gives you *all* these definite advantages:

1. Faster Steaming, more steam and dryer steam.
2. Maximum Heat Transfer.
3. Minimized scale problems. No water line corrosion.
4. Maximum safety. No enclosed construction chamber. No carbon traps.
5. Over-all economy, efficiency and dependable service resulting from the soundness and simplicity of Sellers exclusive immersion firing principle.

Sellers Immersion Steam Boiler Model 46 is available in twelve sizes. All built to A.S.M.E. Power Codes. Write today for Bulletin 1206 C. which gives full details.

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STEAM BOILER

SELLERS ENGINEERING CO.
4876 North Clark St., Chicago 40, Illinois

Blast Heaters — Immersion Automatic Water Heaters — Air Heaters — Combustion Units — Industrial Gas Burners
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you can offer your customers

Radiant Heat

IN ALL THE NEW MODERN METHODS

HORIZONTAL WATER CIRCULATOR

with *THRUSH* forced circulating hot water heat

HEATING METHODS are on the march! Forced Circulating Hot Water Heat, which offers the mildest and most uniform heating, also permits the use of many new and modern heating methods not possible with other forms of heating. It is ideal for radiant heating in any form.

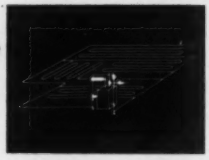
Thrush System gives precise control of temperature for hot water heating, completely eliminates wasteful overheating and assures that continuous feeling of well-being due to the constant presence of radiant heat.

RADIANT CEILING PANELS

Thrush Controls are economical, in both installation and operating costs.

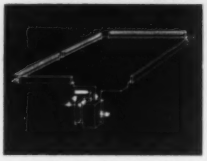
RADIANT FLOOR PANELS

Thrush Controls provide continuous warmth with economical Circulator operation.



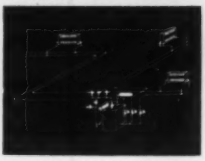
RADIANT BASEBOARD

Thrush Controls maintain comfort, compensate for outdoor weather changes.



RADIATORS · CONVECTORS

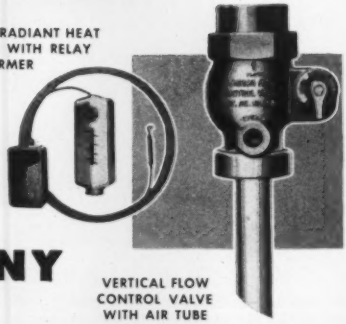
Uniform Heat is always present with Thrush Flow Control System on the job.



ZONE CONTROL

Inexpensive zoning with a Circulator, Flow Valve, and No. 201 Control for each zone.

NO. 201 RADIANT HEAT CONTROL WITH RELAY TRANSFORMER



VERTICAL FLOW CONTROL VALVE WITH AIR TUBE

Ask your wholesaler or write dept. E-6.

H. A. THRUSH & COMPANY

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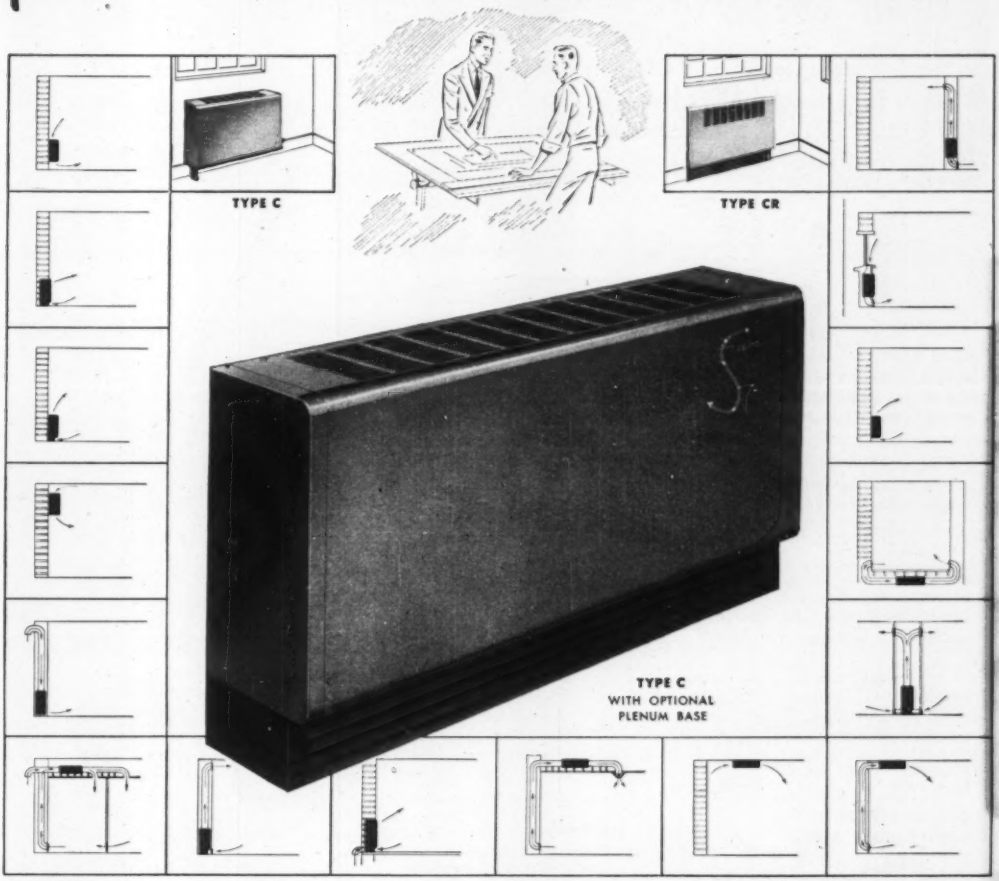
Solve your heating and cooling problems with new Modine Cabinet Units



Whatever your heating and cooling problems — there's a new Modine Cabinet Unit to fit your needs. A single unit for forced hot water heating, chilled water cooling. Steam models for heating only. Smartly designed and easy to clean and service. Quiet operation and quick response make Modines ideal for modern commercial and public buildings. Two basic types in five sizes . . . with optional equipment for meeting a wide range of application requirements.

WRITE FOR NEW BULLETIN 550 TODAY! Your Modine representative is listed in the classified section of your phone book. Or write Modine Mfg. Co., 1509 Dekoven Ave., Racine, Wis.

Modine
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FOR HEATING & COOLING

U-1087

NOTES FROM AN ARCHITECT'S SKETCH PAD

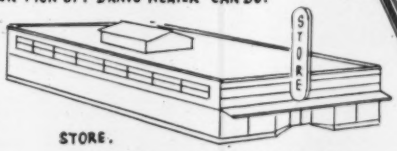
LOOKS LIKE THAT VERSATILE DRAVO "COUNTERFLO" HEATER CAN BE USED ON PRACTICALLY ALL OUR JOBS.

SCHOOL. DISTRICT BUDGET LIMITED. CAN SAVE WITH DRAVO HEATERS.

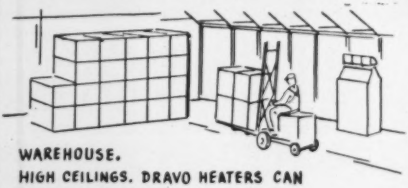
CHURCH. INTERMITTENT HEATING. NEEDS QUICK PICK-UP. DRAVO HEATER CAN DO.

INDUSTRIAL PLANT. DRAVO HEATERS HAVE 150' AIR THROW. NO DUCTS NEEDED.

ARMY BASE.
WINTER CONSTRUCTION ON THESE BARRACKS. CAN INSTALL DRAVO HEATERS EARLY FOR HEAT DURING CONSTRUCTION AND AFTER COMPLETION.

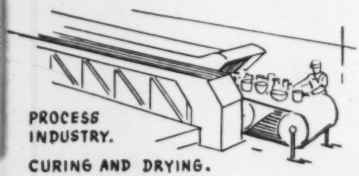


STORE.
WITH DRAVO HEATERS, CAN USE ONE SET OF DUCTS FOR HEATING AND AIR-CONDITIONING.

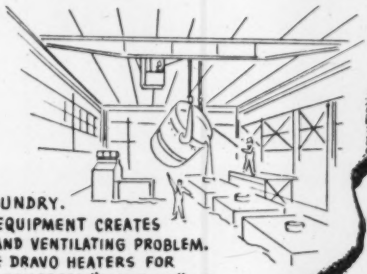


WAREHOUSE.
HIGH CEILINGS. DRAVO HEATERS CAN REDUCE ROOF HEAT LOSS, KEEP HEAT WHERE IT'S NEEDED.

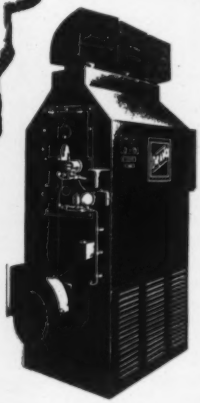
DIESEL RAILROAD SHOP. NEEDS HEAT AT WORKING LEVEL. DRAVO HEATERS IDEAL.



PROCESS INDUSTRY.
CURING AND DRYING. SPECIFY DRAVO HERE.



FOUNDRY.
EXHAUST EQUIPMENT CREATES HEATING AND VENTILATING PROBLEM. USE DRAVO HEATERS FOR TEMPERED "MAKE-UP" AIR.



...kin
...v Dravo.

A case study on any ... installations is yours for the asking. For complete information on how Dravo "Counterflo" Heaters can help solve your heating problems, write for Bulletin LM-526-35

DRAVO
CORPORATION

DRAVO

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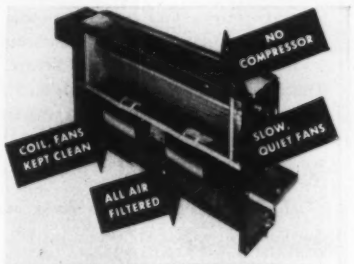
AIR CONDITIONING SYSTEMS *for* **BUSINESS AND INDUSTRY**

NEW DUN & BRADSTREET BUILDING in New York City has G-E Personal Weather Control Air Conditioning. Over 450 G-E room units circulate filtered, fresh air that is cool in summer, warm in winter. Architect: Reinhard, Hofmeister, & Walquist. Consulting engineer: Syska & Hennessy, Inc. General contractor: George A. Fuller Company. Air conditioning contractor: Kerby Saunders, Inc.

Cut first cost...and save in the long run, too, with

G-E PERSONAL WEATHER CONTROL

NO COMPRESSOR IN ROOM UNITS, just quiet, velvet-smooth fans and G-E motor. Room occupants can set temperature as they like without disturbing others. Units are supplied with attractive cabinets (above) or can be concealed in walls. Windows are never blocked.



ALL AIR FILTERED, protecting coils from dust which cuts performance drastically. Filters — inexpensive, changed in less than a minute—reduce room cleaning, avoid costly coil cleaning. Nine-inch deep unit takes little space, circulates air gently through large area.

HERE IS an air conditioning system that in most cases costs less to install...and goes on piling up savings for its owner through many years of operation.

It's General Electric Personal Weather Control, which heats in winter and cools in summer...utilizing individual G-E room air conditioners supplied with hot or chilled water through simple pipe runs from a central heating and refrigeration plant.

HOW YOU SAVE...Valuable space can be saved and alterations can be avoided by supplying ventilation through small-size ducts, the method used in the new Dun & Bradstreet Building (above) in New York City. Installation costs can be reduced even further by installing these systems with no ducts at all...using wall apertures for fresh air.

G-E Personal Weather Control often requires substantially less compressor capacity, saving both installed and operating cost. When rooms are unoccupied, units can be shut off. When there are few people in the building or the system is being started in the morning, units can be operated without the expense of running ventilation equipment.

MAKES YOUR BUILDING MORE PROFITABLE...Tenants enjoy living or working in buildings air conditioned by G-E Personal Weather Control. Each tenant can set the temperature of his room without disturbing others. And it's easier to rearrange office space, because G-E room units are flexible.

It's no wonder that G-E Personal Weather Control Air Conditioning is installed in Houston's Sterling Building ...12 Sheraton Hotels...the prominent new 575 Madison Avenue Building in New York City...and other leading buildings all over the United States.

GENERAL ELECTRIC

FREE DATA to architects, engineers, builders, contractors, and building owners.

General Electric Company, Air Conditioning Dept., Sec. HP-9, Bloomfield, N. J.

Please send me, without obligation, detailed information on G-E Personal Weather Control Air Conditioning.

NAME.....

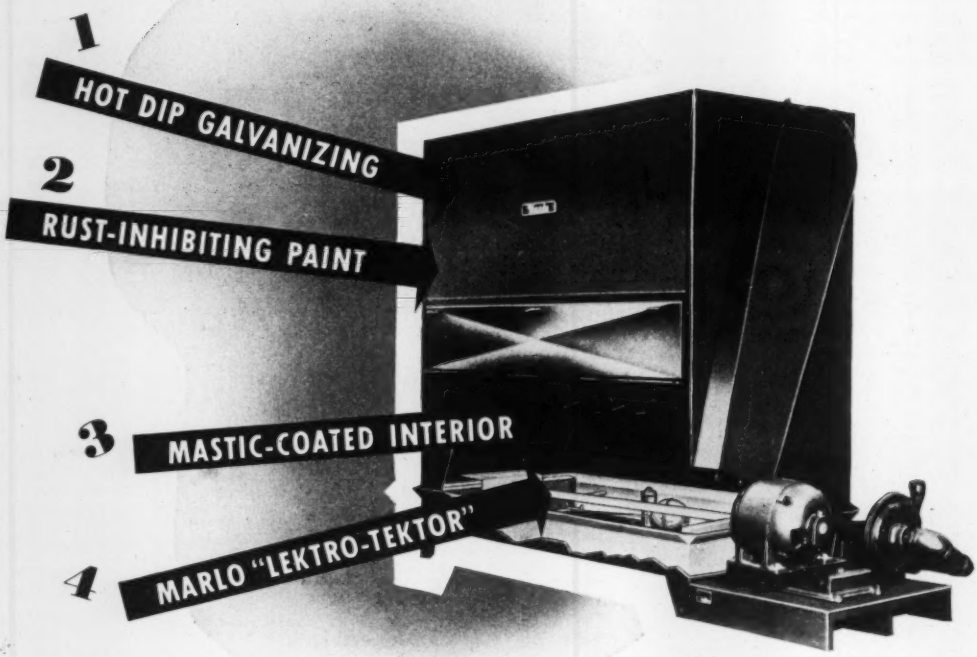
COMPANY.....

ADDRESS.....

CITY..... ZONE.... STATE.....

NOW...MORE IMPORTANT THAN EVER

...MARLO QUADRUPLE PROTECTION against CORROSION!



Marlo Evaporative Condenser

With greater emphasis being placed constantly on *endurance* of equipment, Marlo Evaporative Condensers and Cooling Towers offer this exclusive four-way protection to assure more dependable and longer-lasting installations for you:

OUTSIDE — Marlo galvanized sheets and frames are sprayed with a special rust-inhibiting alkyd resin-base paint that forms an extra front line barrier against corrosive elements.

INSIDE—sheets, panels and galvanized parts are coated with a sound deadening asbestos-asphalt mastic that doubles as an efficient corrosion-retardant. Marlo's exclusive "Lektro-Tektor" affords additional internal protection by preventing electrolytic sump tank corrosion.

Write for information on the complete Marlo line.

Marlo
MANUFACTURERS OF

COIL CO. • 6135 Manchester Rd. • St. Louis 10, Mo.

COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS
AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

FRESH AIR "MADE TO ORDER"

Saves money!

Saves critical materials!

Make DOREX AIR RECOVERY part of your air conditioning or heating installation

Here's what we mean by "made-to-order" fresh air:

To maintain air quality, your ventilation system must continually bring in air from the outside. You have to heat or cool this air—which costs money. But when Dorex Air Recovery is part of the system, only about one-third as much outside air need be taken in. Dorex supplies the rest by making fresh air "to order" from the used air that has already been conditioned.

This is done simply by passing the used air through Dorex C Cells—containers of activated carbon that extract all odorous and gaseous impurities. The air you have already paid good money to heat or cool comes out just as fresh and usable as air from the outside.

Now, let's look closer at savings. You save critical materials because substantially less heating and cooling equipment is required. You save money because you have far less air to condition. On the basis of 20 years' experience and over 7,000 Dorex installations, you can safely figure a $400 saving on original equipment for every $100 invested in Dorex Air Recovery . . . and a $4 saving in operating costs for every $1 spent for Dorex maintenance.

Get the full story of Dorex Air Recovery. Mail the coupon today.

DOREX

Air Recovery

W. B. CONNOR ENGINEERING CORP.

Danbury, Connecticut

Air Diffusion • Air Purification • Air Recovery

In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

TRADE MARK "DOREX" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
Dept. A-61, Danbury, Connecticut

Please send me, without obligation, full information on Dorex Air Recovery

Name .....

Position .....

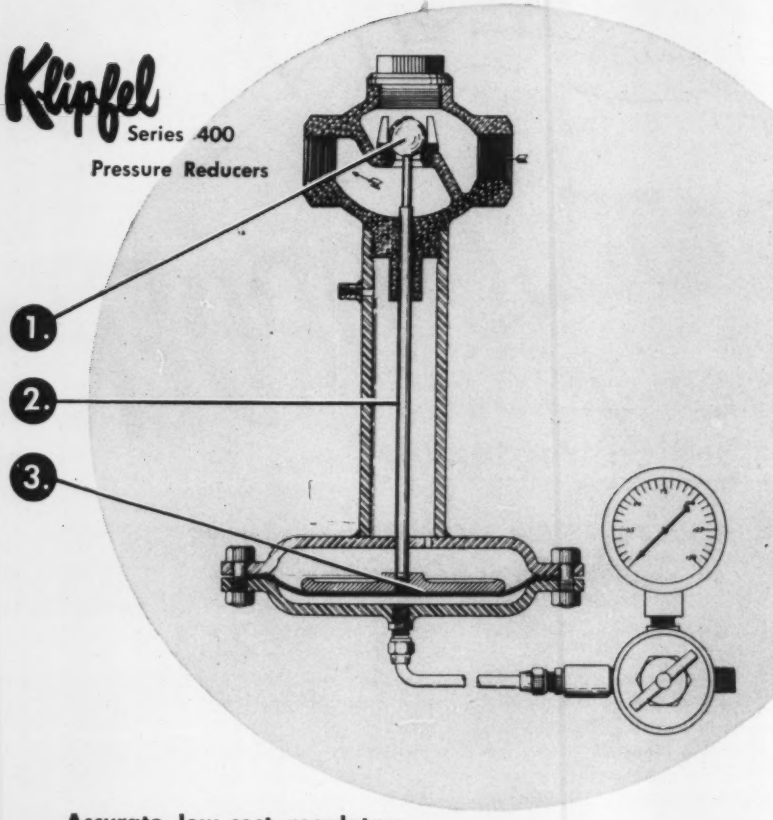
Company .....

Street .....

City ..... **Zone** ..... **State** .....

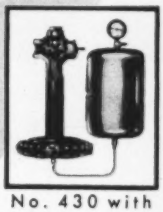
only 3 moving parts

Klipfel Series 400 Pressure Reducers



No. 432 with constant air supply—for quick, easy adjustment.

No. 431 with air dome—for isolated installations.



No. 430 with separate air tank—for variable ambient temperature.

Accurate low-cost regulators . . .

FOR longer service with negligible maintenance, operating parts are reduced to just three, inner valve, stem and diaphragm, in the Klipfel 400 Series air-loaded Pressure Reducing Valves. In addition, these 400 Series Valves provide exceptionally close regulation for an unusually low initial cost.

The stainless steel ball inner valve is a perfect sphere, extremely hard and well guided to close to a tight seat. Easily reseated if necessary . . . is self-cleansing and non-sticking. Diaphragm is always in balance . . . no stress, no bursting. Regulation is accurate and easily controlled. For increased safety, flow automatically shuts off in case of diaphragm failure.

For full data on the Klipfel 400 Series Valves, for steam, air, water or gas, write Dept. F-6 for Bulletin No. 148.

Klipfel VALVES INCORPORATED

DIVISION OF HAMILTON-THOMAS CORP., HAMILTON, OHIO

Dependable Warmth and Comfort

FOR MONONGAHELA HIGH SCHOOL'S 900 STUDENTS

NATIONAL

View of the two No. CA-6630 NATIONAL Commercial Steel Boilers with stokers in the Monongahela High School, Monongahela, Pa. Myers & Myers, Monongahela, Pa., Heating Contractors.

Monongahela High School has modernized its heating system by installing two No. CA-6630 National Steel Boilers to furnish heat for its 22 class rooms, auditorium, gymnasium and cafeteria. These National boilers replace two older front smoke outlet type steel boilers.

The new boilers are stoker-fired and furnish 20,000 square feet of radiation distributed throughout the building by cast iron radiators.

During the 1950-51 winter, which turned out to be unusually severe in Western Pennsylvania, these boilers have operated efficiently and satisfactorily, delivering ample heat throughout the school, on a job where the heating system must be reliable day after day.

The school is planning to install another similar boiler in the near future when the proposed Junior High School addition is built—which will add 16 rooms, a domestic science room, machine and woodworking shop and enlarge the auditorium and gymnasium.

NATIONAL Commercial Steel Boilers are designed and engineered especially for large installations where extra heating capacity is a primary consideration. Their durable construction and economical performance meet or exceed all requirements of recognized authorities and codes, including A.S.M.E. and S.B.I. . . . and they carry the "Hartford Mark" of inspection.

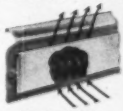
OTHER PRODUCTS OF THE COMPLETE NATIONAL LINE

Cast iron National Heat Extractor boilers in sizes ranging in Net I-B-R Ratings from 170 to 10,300 sq. ft. of steam and from 270 to 16,480 sq. ft. of water.

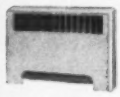
National Steel Boilers in sizes ranging in SBI Net Ratings from 275 to 35,000 sq. ft. of steam and from 440 to 56,000 sq. ft. of water.

The new, all-in-one automatic National Packet Heating Unit for small homes, motels, diners and stores.

National Gas Boilers ranging in net ratings from 105 to 9,600 sq. ft. of steam and from 195 to 15,505 sq. ft. of water. A.G.A. approved for use with all gases.

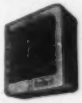


National Art Baseboard



National Art & Aero Convectors

National Art Radiators

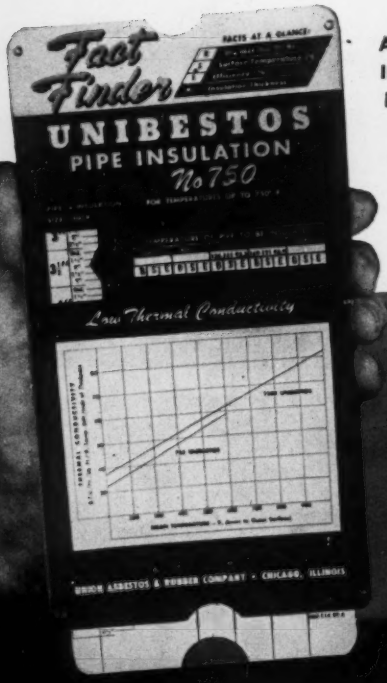


National Unit Heaters

Write for General Catalog No. 586 for information on the COMPLETE line of National Heating Products.

THE NATIONAL RADIATOR COMPANY

JOHNSTOWN, PENNSYLVANIA



ARE YOU WORKING ON ANY PROBLEMS INVOLVING THE INSULATION OF PIPES? LET THIS HELPFUL FACT FINDER GIVE YOU . . .

. . . Btu Loss
. . . Surface Temperature
. . . Efficiency of

UNIBESTOS®
Pipe Insulations

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2 GREAT PIPE INSULATIONS

UNIBESTOS No. 750
—for temperatures up to 750° F.
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—for temperatures up to 1200° F.

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WRITE today, on your company letterhead, giving your title or function. A "Fact Finder" will be sent to you together with complete information on UNIBESTOS Pipe Insulations No. 750 and No. 1200.

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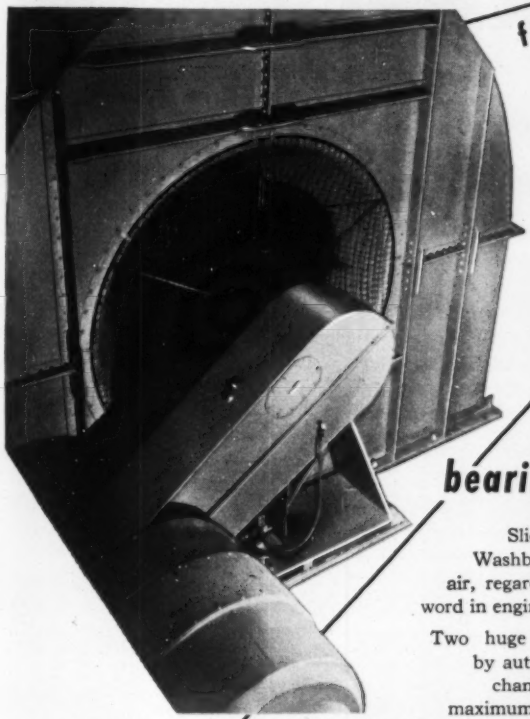
DEPT. 1819A • 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

NO "LUNG SPOTS"

for Houston's Washburn Tunnel



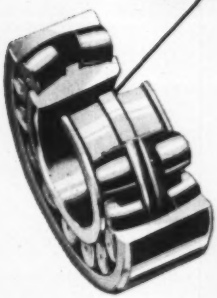
. . . thanks to Westinghouse Sturtevant fans

bearings by SKF

Slicing under the Houston Ship Channel, Washburn Tunnel is guaranteed abundant fresh air, regardless of heavy traffic, thanks to the last word in engineered ventilation.

Two huge Westinghouse-Sturtevant Fans, regulated by automatic electronic controls, supply a complete change of air every two minutes. They have a maximum capacity of 684,000 CFM . . . and friction, need for lubrication and inspection are held to the minimum by SKF Spherical Roller Bearings. It is because of a well-earned reputation for dependability, because of their self-aligning properties and their ability to deliver continuous trouble-free service under adverse conditions that SKF Bearings have been specified for most of the country's major tunnel-fan installations.

7213



8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

integrity
craftsmanship
metallurgy
tolerance control
surface finish
product uniformity
engineering service
field service

SKF
BALL AND ROLLER BEARINGS

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.
—manufacturers of SKF *and* HESS-BRIGHT *bearings.*

OPERATION: FLEXIBILITY

A CLEAVER-BROOKS STEAM BOILER GIVES YOU:

✓ Quick, effortless response to fluctuating steam demands.

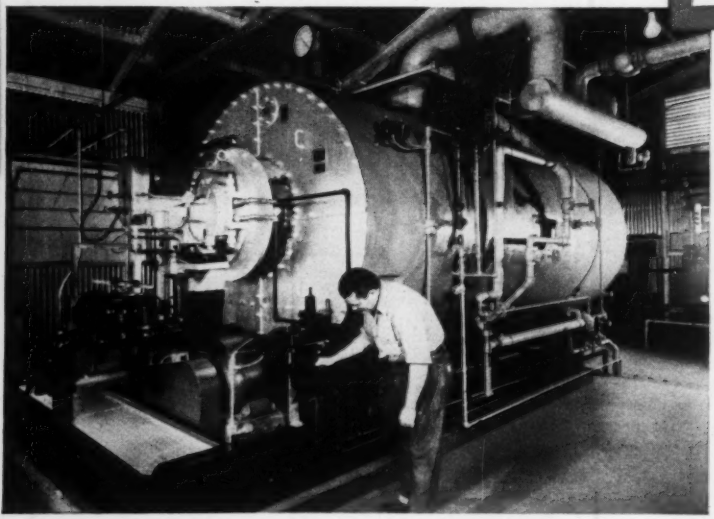
✓ Equally high efficiency (80%) operating with oil or gas.

Fluctuating steam loads are no problem when you have a custom-planned Cleaver-Brooks boiler in your plant. Whether your demand is heavy or light, steady or variable, these sturdy heavy-duty boilers respond instantly to your steam needs. Even with loads as low as 30% of rating, Cleaver-Brooks boilers operate with a flat 80% efficiency.

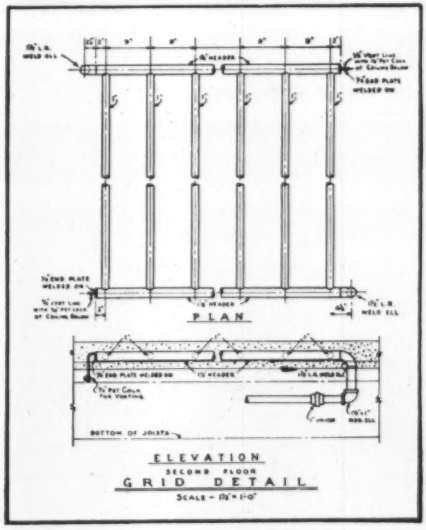
Cleaver-Brooks boilers burn either oil or gas . . . either fuel is properly proportioned to meet your steam demand and need. No banking of fires or loss of valuable heat during low load periods. You benefit with lower fuel bills, less maintenance, reduced operating costs.

If you are considering a change in your present boiler plant—think about flexibility — and get the complete facts about Cleaver-Brooks custom-planned boilers. Cleaver-Brooks self-contained boilers 15 to 500 HP, 15 to 250 lbs., p. s. i. — oil, gas, combination oil and gas firing. CLEAVER-BROOKS COMPANY, 367 East Keefe Avenue, Milwaukee 12, Wisconsin.

Cleaver-Brooks
STEAM BOILERS
the first and finest of their class



Write for a Cleaver-Brooks Steam Boiler Catalog.



FOR MANY YEARS steel pipe has been the standard material for closed hot water systems. It has given long, trouble-free service, completely justifying its extensive use in today's closed radiant heating systems. All the evidence proves you need nothing more costly.

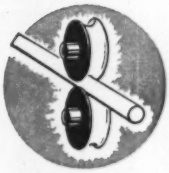
So... figure on using economical Republic Steel Pipe to bid low and land radiant heating jobs—both commercial and residential.

Made under Republic's own improved continuous weld process, Republic Pipe is easy to fabricate and assemble. It's easy to bend, easy to weld, easy to thread. It comes in time-saving long lengths, and plumbing and heating men have years of experience in working with it.

For real economy in all your radiant heating jobs, see your Republic Jobber about the steel pipe you'll need. He'll be glad to give you latest information about available sizes and current delivery schedules.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Dept.: Chrysler Building, New York 17, New York

11,500 feet of ¾" to 1½" Republic Continuous Weld Steel Pipe forms grids and headers in the radiant heating system of this essential new industrial building. For ease of welding and inspection, grids were made up in separate sections, then headers welded in place. Partially completed grid sections were supported on horses to allow welders to work all around the pipe. Finished assemblies easily passed pressure tests. Heating system designed by William H. Silk, Cleveland, Ohio; plumbing and heating contractor is The Scholl-Choffin Company, Youngstown, Ohio.



REPUBLIC CONTINUOUS WELD PIPE

- Easy to bend, thread and close coil
- Easy to weld by all methods
- Uniformly ductile
- Uniformly strong
- Uniformly clean and scale-free
- Uniform wall thickness, diameter, concentricity
- Economical uniform lengths, extra long lengths
- Expansion co-efficient same as concrete and plaster

Republic
STEEL PIPE
for radiant heating

"You Build for your own and your country's future when you save..."

BENJAMIN F. FAIRLESS

President, U. S. Steel Corporation

"A free economy, such as ours, is built on the savings of the people. And the future security of America depends on the initiative and the growth of every citizen. We in U. S. Steel encourage our employees to join the Payroll Savings Plan, and we are proud that the National Tube Company, one of our subsidiaries, was the first of the large industrial companies of the nation in 1950 to have more than 80% of its employees participating. Remember, you build for your own and your country's future when you save."

Mr. Fairless is not expressing a personal opinion, nor is he speaking for other far-seeing executives when he tells you that our economy is built on the savings of the people and a man builds for his own and his country's future when he saves.

Actually, Mr. Fairless is merely putting in words the thoughts and action of the millions of employed men and women who *now hold* more than 50 billion dollars in U.S. Savings Bonds.

$50,000,000,000! Who *sold* all those bonds to millions of people? The answer is, nobody sold them.

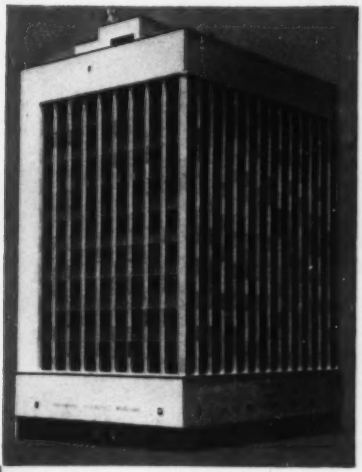
80% of the employees of the National Tube Company ... 75% of the employees of Carnegie-Illinois Steel Company ... thousands of employees of other U.S. Steel subsidiaries ... more than 8 million employees of other companies bought U.S. Savings Bonds and are buying them every month on the easy, automatic Payroll Savings Plan. Their employers merely offered these men and women an opportunity to save for their future. There was no pressure, no emotional appeal.

How does employee participation in *your* Payroll Savings Plan match up with the 80% of National Tube, the 75% of Carnegie-Illinois? Or, perhaps you are one of the relatively few large companies that do not have a Plan? In either case, wire or write, Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Bldg., Washington, D.C. Your State Director is ready to help you with a package plan—application blanks, promotional material, practical suggestions and all the personal assistance you may desire.

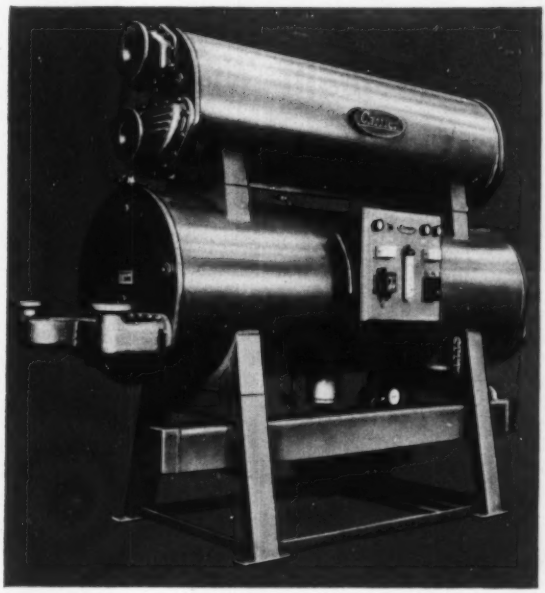
The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the G. M. Basford Company and

Heating, Piping & Air Conditioning

FOR ROOF LOCATIONS



what refrigerating machinery is best?



They're putting the mechanical equipment on the roof nowadays. And for good reason. The move saves space, centralizes equipment, makes basements rentable.

The trend calls for compact lightweight air conditioning equipment like the new Carrier Absorption Machine.

It's smaller and weighs less per ton of capacity than any other refrigerating machine you can buy. Noise and vibration problems are out — because there are no major moving parts — just a small solution pump.

This Carrier Absorption Machine operates at a minimum cost, too. It uses steam (often idle capacity or waste steam) to produce cooling. The steam rate is less than 20 pounds per hour per ton of refrigeration. It automatically adjusts itself to partial loads — down to 10% of capacity, with sustained efficiency.

Send for our interesting folder describing new, lightweight 115 to 350 ton capacity refrigerating machines. Carrier Corporation, Syracuse 1, N. Y.

Top right: Employers' Insurance Building, Dallas.
Top left: Self Memorial Hospital, Greenwood, S. C.

Carrier

Air Conditioning Refrigeration Industrial Heating

he's free of concern . . . his plant won't burn

Going home . . . relaxing after a day of high-geared activity is no trouble for this executive! His mind's at ease about fire . . . a short circuit, a stray spark, a forgotten cigarette or spontaneous combustion . . . all these and many more are definitely under control 24 hours a day, thanks to efficient, quick-acting C-O-TWO Fire Protection Equipment.

You, too, can have this same peace of mind . . . this same positive protection from costly fires by installing complete, approved C-O-TWO Fire Protection Equipment. For instance, at many locations, with today's high costs and delayed replacements, a C-O-TWO Combination Smoke Detecting and Fire Extinguishing System is a "must." The first trace of smoke in a protected area sounds an alarm . . . then fast, clean, non-damaging, non-conducting carbon dioxide blankets the fire, putting it out in seconds, before it spreads and causes extensive damage . . . no after-fire mess, no water damage with carbon dioxide.

Also, C-O-TWO Portable Fire Extinguishers . . . either carbon dioxide type or dry chemical type . . . render fast, positive action for extinguishing fire during the incipient stage. C-O-TWO Portable Fire Extinguishers are designed to take abuse . . . rugged construction, no extra gadgets protruding or complicated operating parts . . . built to rigid specifications to assure you of lasting, efficient fire protection.

Remember . . . you can't put fire off . . . fire doesn't wait! For expert advice, let a C-O-TWO Fire Protection Engineer help you in planning complete and up-to-date fire protection facilities now. Write us for free information . . . our experience is at your disposal.

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 • NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

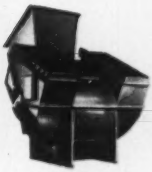
Affiliated with Pyrene Manufacturing Company

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers • Built-In Smoke and Heat Fire Detecting Systems
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems

American Blower—a time-honored name in air handling

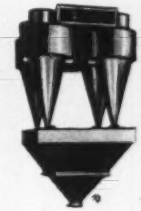
Venturafin Unit Heaters



Mechanical Draft Fans

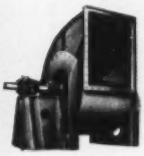
Utility Sets

Ventura Ventilating Fans



Dust Collectors

Air Washers



Industrial Fans

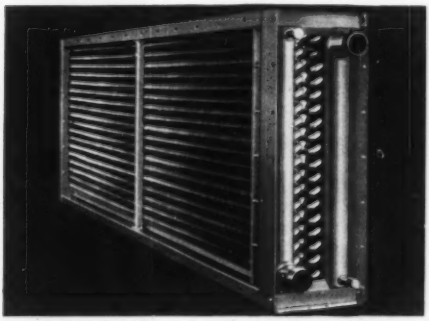
Heating and Cooling Coils

Air Conditioning Equipment

There's a big difference in quality, design, quietness, operating costs and efficiency between American Blower and ordinary air handling equipment. Compare! Look before you buy—and you'll buy American Blower products every time.

In Dallas, as in other cities, American Blower Air Handling Products serve commerce, industry and public utilities. For air handling data in the Dallas area, call American Blower—Central 5518. In other areas, consult your phone book.

Product of the month



American Blower Cooling Coils are available in a wide range of tube faces, lengths, coil depths and fin spacings.

Order American Blower Cooling Coils now

American Blower Cooling Coils are specially designed for use in air conditioning systems, industrial process work and dehumidifying applications.

Three types are available: (1) *Type W Water Coils* for all normal cooling and dehumidifying requirements using refrigerated or naturally cold water; (2) *Type C Cleanable Water Coils*, fitted with cleanout plugs for use where water used tends to deposit solids in tubes and headers; (3) *Type X Direct Expansion Coils*, for use with direct expanded refrigerants. All are made in many shapes and sizes, giving a wide range of capacities.

With American Blower Cooling Coils, famous for built-in quality, you are assured of years of dependable service. Investigate now. Contact your nearest American Blower Branch Office for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

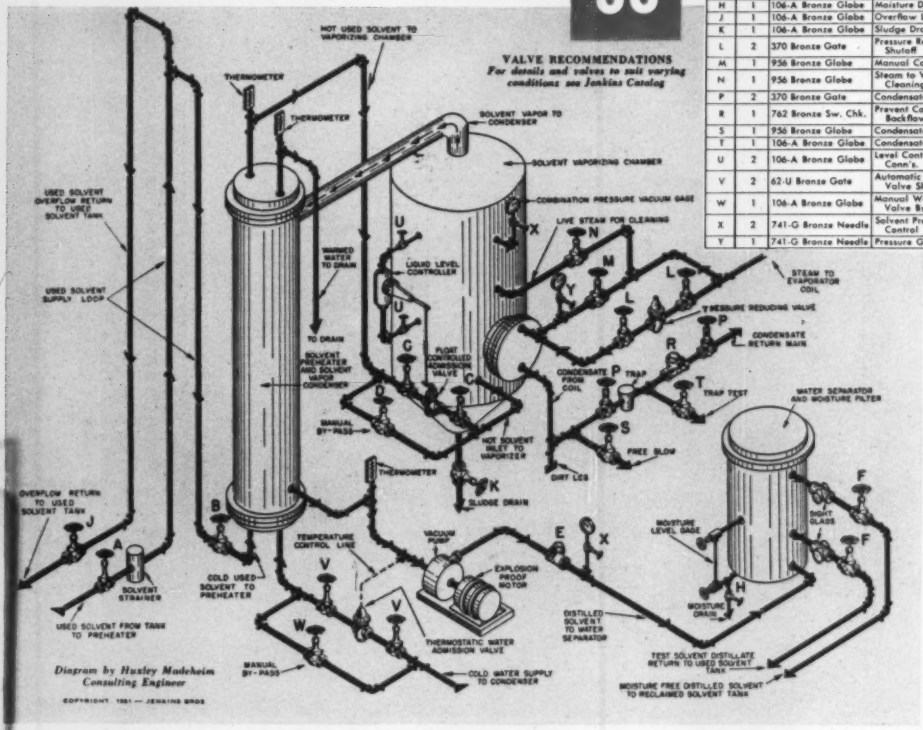
Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

JENKINS PRACTICAL PIPING LAYOUTS

55

Code	Quan.	Jenkins Valves	Service
A	1	62-U Bronze Gate	Used Solvent Supply Shutoff
B	1	106-A Bronze Globe	Used Solvent to Preheater
C	2	62-U Bronze Gate	Float Controlled Valve Shutoff
D	1	106-A Bronze Globe	Manual By-Pass of Float Valve
E	1	92 Br. Sw. Check	Prevent Solvent Backflow
F	2	106-A Bronze Globe	Tank Connections for Distilled Solvent
H	1	106-A Bronze Globe	Moisture Drain
J	1	106-A Bronze Globe	Overflow Line Control
K	1	106-A Bronze Globe	Sludge Drain from Vaporizer
L	2	370 Bronze Gate	Pressure Reducing Valve Shutoff
M	1	956 Bronze Globe	Manual Control By-Pass
N	1	956 Bronze Globe	Steam to Vaporizer for Cleaning
P	2	370 Bronze Gate	Condensate Return
R	1	762 Bronze Sw. Chk.	Prevent Condensate Backflow
S	1	956 Bronze Globe	Condensate Free Blow
T	1	106-A Bronze Globe	Condensate Trap Test
U	2	106-A Bronze Globe	Level Controller Tank Conn's.
V	2	62-U Bronze Gate	Automatic Admission Water Valve Shutoff
W	1	106-A Bronze Globe	Manual Water Admission Valve By-Pass
X	2	741-G Bronze Needle	Solvent Pressure Gage Control
Y	1	741-G Bronze Needle	Pressure Gage Control



How to plan DRY CLEANING SOLVENT DISTILLATION PIPING CONNECTIONS

In the distillation system shown, used solvent is pumped from a storage tank through a strainer to a preheater. Here, cold solvent on the inside of the tubes is heated by the solvent vapors on the outside.

The heated solvent then passes through a liquid level controller to the solvent vaporizing chamber. A steam coil in the vaporizer further heats the solvent and causes it to boil off, since it has a lower boiling point than the impurities. A sludge drain valve is used to remove these impurities periodically from the bottom of vaporizer where they collect (hence a high vacuum is maintained).

The reclaimed solvent generally is returned to the used solvent storage tank for reprocessing. It is then passed through filter pads where any last traces of moisture are removed and stored in a tank for reuse.

The valve recommended for control of both hot and cold solvent is Jenkins Fig. 106-A Globe Valve. When ordered for use in dry cleaning solvent lines, valves are fitted with Jenkins No. 936-A synthetic composition discs. These are specifically designed to withstand the corrosive action of solvents, and provide vapor-tight closure for a long period before disc renewal is required.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

COMPLETE DESCRIPTION AND ENLARGED DIAGRAM OF THIS LAYOUT FREE ON REQUEST. Includes additional detailed information. Mail coupon for your copy.

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JENKINS

LOOK FOR THE DIAMOND MARK

VALVES SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

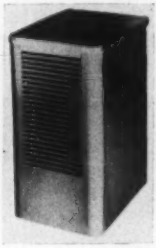
EQUIPMENT DEVELOPMENTS...

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1951 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

Air Filter

HPAC 1—The glass fiber air filter material produced by Glassfloss, 155 E. 44th St., New York is now being made up in standard size rolls, 40 in. wide and 10 ft long, in both 1 in. and 2 in. thickness. The new product, "Roll-Pak," eliminates the need for disposable frames, since coarse wire screening requiring no replacement can be used on both input and output sides of the filter. The five rolls packed in each carton provide air filter coverage of 167 sq ft. For filter replacement, the material is rolled out, cut to size and installed between the screening. Since strips are cut to maximum lengths (so that a single strip may do the work of many single units), replacement time is minimized.

Air Filter



Dehumidifier

Dehumidifier

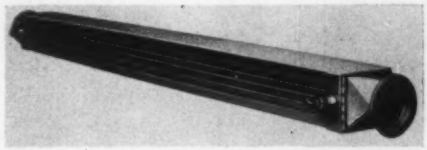
HPAC 2—A portable (60 lb) 1/8 hp "Humidry" unit for use in basements, vaults, storage lofts, etc., is now available from Carrier Corp., Syracuse, N. Y. The unit plugs into a standard 115 volt circuit, and is said to be capable of removing 18 pints of water per 24 hr from an average air space at 80 F and 70 percent relative humidity. The vertical arrangement of spiral finned evaporator coils (resulting in continuous downward drainage of water) is said to prevent accumulation of water on the coil. Drain disposal is possible if rubber tubing is attached to the drip pan spout.

Duct Connection

HPAC 3—An all asbestos flexible duct connection has been developed by Grant Wilson Inc., 141 W. Jackson Blvd., Chicago 4, Ill., for use in stopping noise travel and vibrations in automatic or mechanical forced air heating, air conditioning and ventilating equipment. Both edges are selvaged to prevent fraying or unravelling. The connection may be installed with sheet metal screws, clips, metal bands or fastening bolts. It is fireproof, and is said by the manufacturer to have great tensile strength.

Solvent Recovery Unit

HPAC 4—A plate type heat exchanger especially designed for solvent recovery is now manufactured by Modine Mfg. Co., Racine, Wis. Interlocked channel type



fins and special embossings or interrupted surfaces are said by the manufacturer to provide surface area ranges from 250 to 300 sq ft per cu ft. The units can be assembled into blocks for varying capacity requirements, and are at present offered only where quantity requirements warrant production.

Power Transmission Chain Drive

HPAC 5—The "Hy-Vo" power transmission chain drive developed by Morse Chain Co., 7601 Central Ave., Detroit 8, featuring a new chain and sprocket engagement principle, is said to minimize "chordal" action and reduce shock loading and chain link stresses. The new sprockets have curved involute teeth which engage links with conjugate action. A compensating rocking joint designed to reduce vibration shifts the pitch line automatical-

FOR YOUR CONVENIENCE [6-51]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118		120
121	122	123	124	125	126	127	128	129	130
131	132								

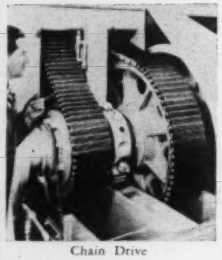
Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

ly, engaging the involute sprocket teeth in such a way that the chain follows a path tangent to the sprocket pitch line. The units are said to transmit as much as 5000 hp, at linear speeds up to 6500 fpm or rotative speeds to 3600 rpm. They are recommended for use with large fans and heavy duty ventilating equipment, and in any field where single motors or engines are used in sizes of about 100 hp and up.



Chain Drive

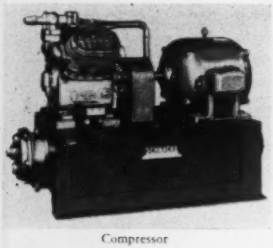
Gage Valve

Gage Valve

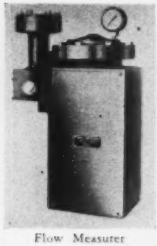
HPAC 6—Edward Valves, Inc., East Chicago, Ind., has developed a male inlet and female outlet design in its ½ in. forged steel gage valve series. The male inlet, an integral part of the steel body, substitutes for, and serves the same purpose as nipples. Because of its compactness, the valve is recommended by the manufacturer for use in cramped areas, as in instrument piping, or for installation on manufacturer's equipment. Ratings are 4000 lb at 150 F or 600 lb at 750 F.

Air Conditioning Compressors

HPAC 7—The standard compressor line of Schnacke, Inc., 1016 Columbia St., Evansville, Ind., now includes three direct drive models (operating at 1750 rpm) formerly produced on special order only. They are available as complete condensing units, and may be used for slower speed applications as well as at top capacity. Featured are steel backed alloy replaceable bearings, force feed lubrication, and bellows type seals. The company has also added as standard a line of condensing units from 30 to 60 tons.



Compressor



Flow Measurer

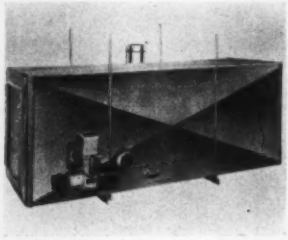
Flow Differential Measuring Unit

HPAC 8—The "High Pressure Flow Signal Transmitter" developed by Hagan Corp., Hagan Building, Pittsburgh 22, is a pneumatically operated unit for measuring flow differential in liquids, gases or vapors, or measuring static pressure or liquid level. The unit, which transmits proportional signals to remote recording or indicating instruments or to automatic control units, is now being used in process industries, metallurgy and in steam power plants. It consists of an input differential pressure measuring unit, force balanced by an output system. Balancing force originates in a modulated loading air pressure resulting from action on an escapement type pilot valve following any unbalance of linkage forces. Interchangeable measuring elements cover a continuous range of pressure differential from 5.5 in. water column to 100 psi, at static pressure up to 1500 psig.

Valve Actuators

HPAC 9**—A new line of valve actuators designed for the operation of gate valves, plug valves, dampers, diaphragm valves, butterfly valves and sluice gates, has been introduced by Ledeen Mfg. Co., 1602 So. San Pedro St., Los Angeles 15, Calif. The actuators are basically the company's cylinders, equipped with brackets, valves, controls and couplings. They can be adapted to any make, size and type of valve, can operate against any line pressure, work on any fluid medium, and with any pressure available, says the manufacturer. They can be arranged for on-and-off or for positioning service.

Actuator



Furnace

Oil Fired Furnace

HPAC 10**—Cox Mfg. Co., Ridgeville, Ind., has developed a new "Wondaire" suspended oil fired furnace for use in warehouses, factories and other buildings. The eight models range from 80,000 to 500,000 Btu output at the bonnet. They are shipped completely assembled with thermostatic and safety controls, and hanging rods. The heat exchanger is of a tubular construction said to facilitate uninterrupted air flow through the unit. The pre-cast refractory is built to withstand temperatures up to 2800 deg, and overlaps sufficiently into the heat exchanger to prevent flame impingement, the manufacturer states. Operating efficiencies up to 87½ percent have been shown. The unit uses a gun-type burner and a two-stage pump. Both the blower and motor are mounted free of the furnace jacket.

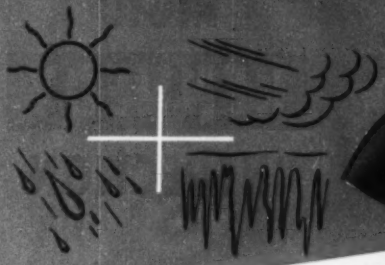
Cooler

HPAC 11—A new ceiling type "Comfort Cooler" fitted with a standard size throw-away filter has been developed by Kramer Trenton Co., Trenton 5, N. J. The unit is mounted in the conditioned area, but the compressor may be installed elsewhere. L-shaped and other unusually shaped areas can be serviced by two or more of these units,

[*Continued on page* 172]

Controlled Ventilation

REGARDLESS OF WEATHER



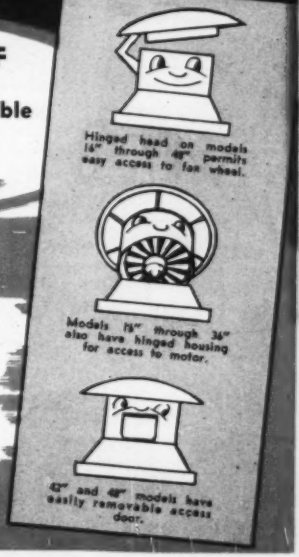
DeBothezat Power-Flow Roof Ventilator is a motor driven fan unit in a weather-proof housing, guaranteed to provide positive ventilation at all times. Power-Flow Roof Ventilators can be used either for air exhaust or intake, either with or without duct systems. Low, streamlined design blends well with modern architectural designs. Power-Flow Roof Ventilators are available with fan wheels 12" through 48" in diameter, delivering up to 40,900 CFM.

NEW
12" POWER-FLOW VENTILATOR

For toilets, locker rooms and small buildings. Provides 975 CFM at free delivery. Equipped with weatherproof removable head, copper insect screen and permanently lubricated enclosed motor.

FREE BULLETINS — Illustrated literature on Power-Flow Roof Ventilators includes specifications and dimensions for all sizes. Ask your local DeBothezat agent or write our factory, Dept. H651.

LIGHT-PROOF AT NIGHT
to comply with possible BLACKOUT regulations


Hinged head on models 14" through 48" permits easy access to fan wheel.
Models 15" through 24" also have hinged housing for access to motor.
42" and 48" models have easily removable access door.

Power-Flow

ROOF VENTILATORS

Built by

DE BOTHEZAT FANS DIVISION
AMERICAN MACHINE AND METALS, INC.
East Moline, Illinois

RIGID KENNEDY INSPECTION

Guarantees Fittings Free of Leaks, Burrs and Scales

KENNEDY MALLEABLE-IRON screwed fittings are made with tough, close-grained iron, tested to 43,000 psi. Carefully controlled annealing prevents splitting or cracking under almost any distortion forces. Uniform hot-dip galvanizing assures a heavy coating that will not chip or flake. Precision machining provides exact alignment . . . speeds installation time.

KENNEDY CAST-IRON screwed and flanged fittings are made with tough, close-grained metal *more than* 50% *stronger* than ordinary gray iron. Precision threading and accurately machined flanges help you get strong, tight joints easily. The complete Kennedy line also includes cast-iron sprinkler and drainage fittings, cast-iron flanges.

KENNEDY BRONZE fittings with tensile strength of 34,000 psi are individually tested to 100 lbs. air pressure under water to insure freedom from leaks. Available rough or polished in all standard types and sizes.

WRITE FOR BULLETIN 104

KENNEDY INSPECTED FITTINGS

THE KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS

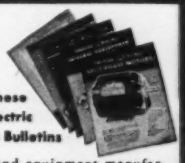
"Quiet" POWER

NOISE is on the black list. Quietness commands a top position in surveys made to rate the most desirable features of motorized products. How does *your equipment* meet this present-day standard?

Many of America's leading products depend upon the quiet power of Emerson-Electric Motors to drive their operating mechanisms. These products also benefit from the quality construction and dependability of Emerson-Electric Motors, which are equally important factors in long-term customer satisfaction.

The accumulated experience in designing and manufacturing Emerson-Electric Motors, dating from the pioneering days of 1890 to the present, is yours to command without obligation. Ratings 1/20 to 5 h.p. Your inquiry is invited.

THE EMERSON ELECTRIC MFG. CO.
St. Louis 21, Mo.



Write for these Emerson-Electric Motor Data Bulletins

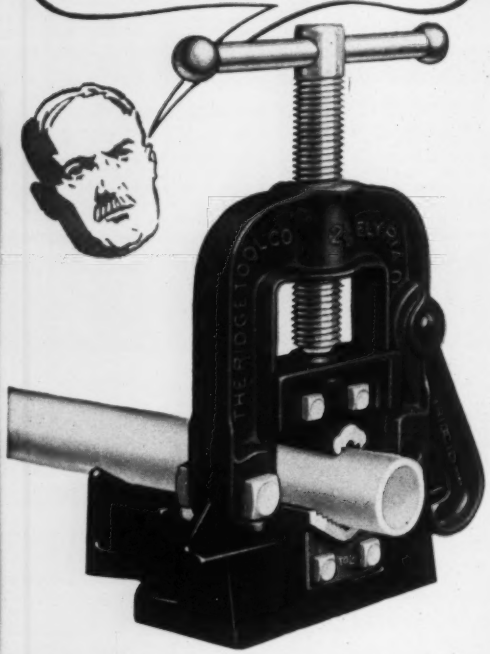
Appliance and equipment manufacturers, with applications for motors of 1/20 to 5 h.p., can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ 136-A Capacitor-Start
- ☐ 136-B Split-Phase
- ☐ 136-C Integral
- ☐ 136-D Fan-Duty
- ☐ 136-E Oil-Burner
- ☐ 136-F Jet Pump
- ☐ 136-G Blower

EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

The Handy Durable RIDGID Bench Yoke Vise

It's got what you need for easy work



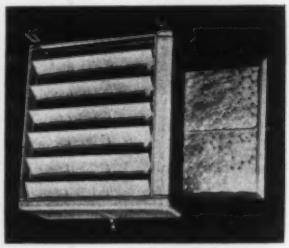
● You save time and effort with this more-for-your-money RIDGID Bench Vise. Right where you need 'em are its integral pipe rest and benders that won't flatten pipe—and heat-treated tool-steel LonGrip jaws mean you don't have to be so fussy with polished pipe. Special malleable frame, extra durable. 8 sizes to 6" pipe, bench, post, stand and Tristand models, yoke and chain. Order from your Supply House.

RIDGID

★ Work-Saver Pipe Tools ★

[*Continued from page* 168]

and no ducting is required. Use of rubber mounted, low-speed motors is said to minimize vibration and noise level. Units have a nominal capacity of 2.6 tons and can be used with a 2 or 3 hp compressor. Capacity is 17,000 Btu per hr with entering air of 70 F dry bulb and 70 percent relative humidity with 30 F refrigerator temperature.



Cooler

Valve

Valves

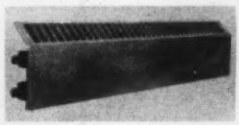
HPAC 12—Homestead Valve Mfg. Co., P. O. Box 550, Coraopolis, Pa., has added worm and gear operated valves to its line of lubricated plug valves. These "Figure 502 GW" valves have port area equivalent to 100 percent of the area of standard pipe, are cast in semi-steel, and made in 8 in., 10 in. and 12 in. sizes. They will soon be available in cast-steel, full-port type and in venturi type sizes up to 14 in.

Finned Pipe Radiation

HPAC 13—C. A. Dunham Co., 400 W. Madison St., Chicago 6, has recently introduced the new "Fin-Vector" unit. This finned pipe radiation is offered with several types of covers for use in showrooms, offices, schools, factories, and similar installations.

A new type of adjustable hanger for two or three-tier assemblies is used. Only the top tier need be fastened as the lower tiers hang freely.

These units are offered in two sizes; 1¼ in. tube with 3¼ in. square fins, and 2 in. tube with 4¼ in. square fins. Fins are spaced 24, 32, or 48 per lineal foot of tube, depending on heating capacity desired. Available covers include the sloping top type, the flat top type, and the diamond mesh expanded metal type. All are designed to accommodate one, two or three-tier installations.



Radiation Unit

Sealing Ring

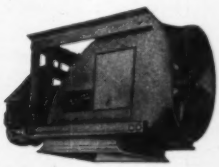
Sealing Ring

HPAC 14**—The "Inseal," a one-piece sealing ring with the sealing member located on its inner side, is now available (in diameters from 4 to 96 in.) from the Double Seal Ring Co., Fort Worth, Texas. Since only one material is exposed to cylinder walls, the ring is said to minimize wear when walls are insufficiently lubricated. Sealing fully from both sides (the seal extends the width of the ring), the product is recommended for use on single-

WING VENTILATING EQUIPMENT

WINGFOIL SAFETY VENTILATING FAN

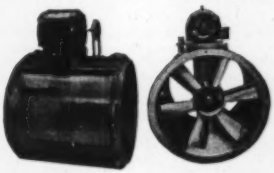
Distinguished for efficiency and rugged construction. The new Wingfoil fan wheel moves maximum volumes of air with minimum horsepower, due largely to its non-overloading feature. Sizes from 10" to 60" dia., with free air capacities from 825 to 59,000 CFM. Larger sizes on special order. Either direct or belt drive. Heavy steel guards provide safety.



WINGFOIL DUCT FAN

(Elbow Type)

Designed to form an elbow in the duct system, the elbow-shaped housing in a strong rectangular frame permits installation with the inlet in any desired position. Motor and drive are outside the air stream, therefore remain cool, clean, and easily accessible. The new Wingfoil Fan has a remarkable "non-overloading" characteristic. Sizes 10" to 60"; capacities up to 85,000 CFM.

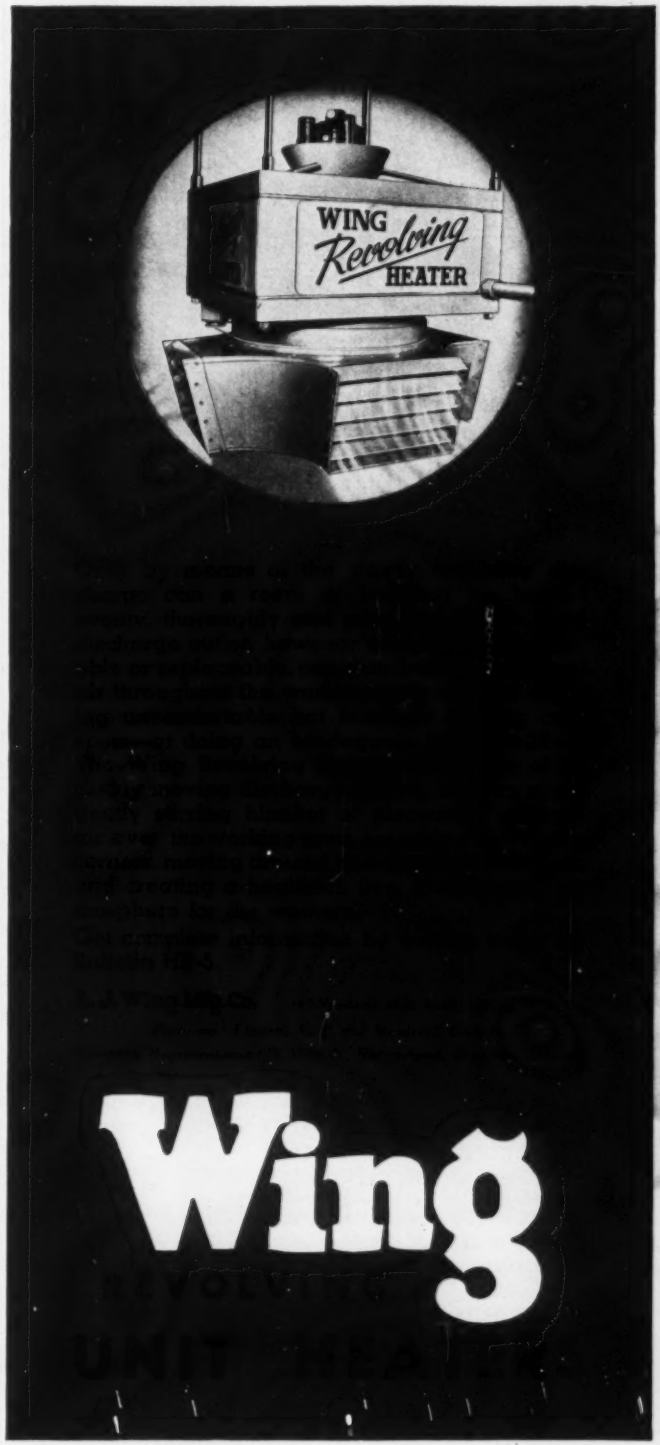


WINGFOIL DUCT FAN

(Straight Line Type)

Designed to form a part of any straight run of duct. The motor is mounted on an adjustable base outside of the housing. V-belt drive is through an air tube carried across the housing and supporting fan shaft and bearings. Fan wheel is the new non-overloading Wingfoil Fan. Bearings are grease-sealed, requiring minimum of attention.

Write For Bulletins



. . . and for help with the temperature control, we'll talk to Honeywell!

The architect in Virgil Partch's cartoon has a mighty sound suggestion, because Honeywell *can* help heating engineers and contractors provide the proper thermal environment for any client—anywhere—in any kind of structure.

We have a lot of literature on the automatic control of all phases of heating, ventilating and air conditioning. Information you should have in your files.

And we have a lot of very well informed control engineers—in our 91 different offices—who have a lot more information right at their finger tips.

We sincerely believe we can help you on any project that poses problems of control of any kind—for *control* is Honeywell's business.

So, why not *talk to Honeywell?* Why not *write* to Honeywell for complete information on the equipment discussed in the column across the page? And why not do it *now?*

MINNEAPOLIS
Honeywell
First in Controls

groove, double-acting pistons. A semi-locking arrangement on one of the ring ends prevents protrusion into cylinder wall openings and lessens danger of catching ring ends in the cylinder ports of two-cycle engines.

Fiber Ducting

HPAC 15**—Sonoco Products Co., Hartsville, S. C., has designed the "Sonoairduct" fiber duct which, embedded in concrete floor slabs, is used as a supply or return line in radial or perimeter warm air heating with oil or gas furnaces. The duct is available in lengths up to 25 ft and in ID's from 2 to 24 in. Fiber collars for joining sections in straight runs are available in 12 in. lengths, but metal accessories are recommended for other types of connection. A 4 ft length of 8 in. ID weighs 6½ lb. The product is fire- and moisture-resistant.

Two-Stage Pumps

HPAC 16—Economy Pumps, Inc., division of Hamilton-Thomas Corp., Hamilton, Ohio, offers a redesigned line in its "Type DMD" two-stage pumps. Models now range in size from 2 in. to 10 in. discharge, and have capacities up to 4000 gpm and heads to 750 ft. Construction features include a horizontally split casing with interconnecting passage between the two opposed, non-overloading type impellers, a large diameter shaft carried on cartridge-type ball bearings and an angular contact duplex bearing for thrust. The pumps may be used in high head water works, hydraulic elevators, oil refineries, boiler feeding and similar applications.

Circuit Breaker

HPAC 17—For low-voltage industrial and commercial applications, Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., offers a new air circuit breaker with an interrupting capacity of 50,000 amp. The unit contains an adjustable air-delayed series overcurrent tripping device for delay on overloads and tripping of fault currents. For use on feeder and back-up breakers, trip units including both long and short time delay elements are available. Rated at 600 volts a-c, 250 volts d-c, the unit has a continuous rating of 100 to 1600 amp. It can be operated manually or by d-c or a-c solenoid.

Scaling Hammer

HPAC 18**—The newly organized firm of Jack Churchward Welding Accessories, North Haven, Conn., has introduced a scaling hammer featuring a multi-point hammering surface designed for quick descaling, a hollow ground scraping head for removing weld spatter, and a slagging pick for removal of slag from weld pockets, corners and from the edges of a weld.

According to the manufacturer, the well balanced handle reduces worker fatigue.

Suspended Oil-Fired Furnace

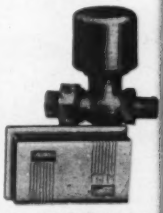
HPAC 19**—Air Conditioning Engineering Co., 44 First Street, Cambridge 41, Mass., offers the "Perfectaire" oil fired suspended furnace, in three models with a range of from 112,000 to 450,000 Btu per hr at outlet.

Designed for open space heating in garages, stores, factories, churches etc. and for temporary and emergency needs, this unit requires no ducting or chimney footing,

8½" by 9" reproductions of this Partch cartoon are available upon request

For help with any control problem, talk to Honeywell!

Radiator valves, for instance . . .



Here's a remarkable advance in pneumatic valve design—Honeywell's new "Midget." Only *one-fourth* the size of the conventional valve, it's ideal for any application where you're pressed for space.

You'll find it mighty helpful when you're working on apartments, schools, hospitals and other large buildings that call for compact pneumatic heat controls. And your clients will like its neater, streamlined appearance; its lower installation and maintenance costs.

The Midget Radiator Valve is superior in *performance*, too. Special internal features such as interchangeable parts enable it to give true modulation of heat delivery for any size radiator or convector.

Development of this amazing new valve is just one more example of how Honeywell leads the way in improved design in the pneumatic heating control field. When it's used with the Room Grad-U-Stat—or any of the other dependable, accurate Honeywell pneumatic thermostats that are available—you have the finest kind of pneumatic heating control system yet designed.

☐ Please send me complete information on the VO501 "Midget" Radiator Valve and other pneumatic temperature controls.
☐ Please send me a reproduction of the Partch cartoon.

Name _____

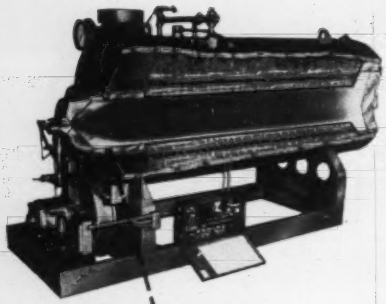
Firm Name _____

Address _____

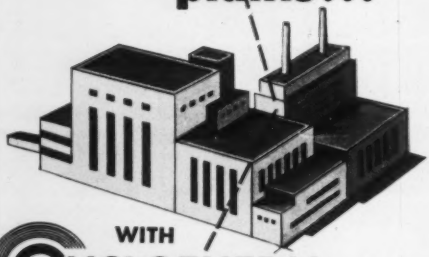
Send this coupon today to Dept. HP-6-102 Minneapolis 8, Minn.

MINNEAPOLIS **Honeywell**

First in Controls



modern power for modern plants...



WITH CYCLOTHERM steam generators

The Cyclonic Combustion method of steam generation assures a GUARANTEED 80% efficiency. In the modern American factory efficiency is the keynote of profit.

Write for complete information on the CYCLOTHERM cyclonic principle. You'll receive proof why this truly amazing generator is recognized by American industry as being years ahead in steam generation.

Boilers are designed for oil or gas operations from 18 thru 500 h.p., 15 to 200 lbs. operating pressure.

CYCLOTHERM CORP. Oswego, N.Y.

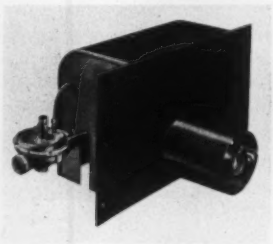
Your phone book will give you the address of your local Cyclotherm office or write Dept. N

Years Ahead in Steam Generation

though it may be used with ducts. Automatic thermostatic controls operate both burner and blower, and a two-stage pump draws the fuel. Consumption of No. 2 or No. 3 oil is said to be (under most favorable conditions) 1.0 to 1.3 gph for one model, 2.0 to 2.5 for another model and 3.5 to 4.0 for the third.

Gas Burner

HPAC 20—A new inshot gun-type gas burner has been introduced by Delta Heating Corp., 85-07 Northern Blvd., Jackson Heights, N. Y. Recommended by the manufacturer for use in wet base boilers with low crown sheets, and as a replacement for oil burners, it is also applicable to all types of heating and process boilers, furnaces and large cook stoves. No combustion chamber or refractory base is required. A runner pilot permits lighting from outside the furnace. The burner is available for use with natural, mixed or manufactured gas, and the three sizes range from 80,000 to 300,000 Btu per hr.



Gas Burner

Shaft Seal

Mechanical Shaft Seal

HPAC 21**—To meet the shaft sealing needs of pump manufacturers, Sealol Corp., 45 Willard Ave., Providence 5, R. I., is offering the FCB and GCB "balanced pressure" seals.

These all-in-one units are factory assembled and tested and are designed to eliminate the possibility of lost parts, damaged parts, faulty assembly, or contamination of the lapped seal faces. Rubber friction members, incorporated in the rotating and stationary elements of the seals, are used to provide the driving and holding actions. This design, says the company, permits hand assembly of the seal in the pump.

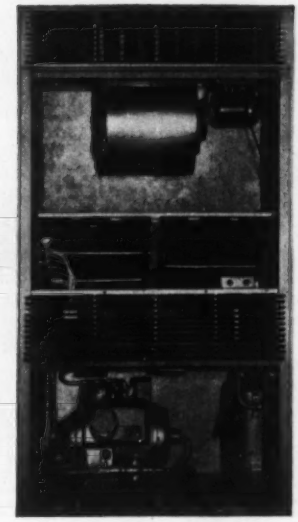
Seals are constructed of corrosion resistant materials and can be furnished to handle water, oil, kerosene, gasoline, etc. They are available for shaft sizes from $\frac{3}{8}$ to 1-$\frac{1}{2}$ in.

Delayed Action Relay

HPAC 22—Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 3, Mo., has developed a new delayed action relay for use with diaphragm control valves operating in series (through "split" ranges). An incorporated spring delays opening of the output port until a loading pressure is reached above that which the spring can absorb. If the new relay is used with the company's Type 217 relay, standard 3 to 5 lb range control valves can be fully travelled with primary control pressure changes as low as 2 or 3 lb, says the manufacturer.

The company has also developed a reverse action relay

EVERYTHING YOUR CUSTOMER WANTS



IN A PACKAGE AIR CONDITIONER

Here are the reasons why your customer will be happy with his Worthington Package Air Conditioner:

QUIET—acoustically insulated cabinet . . . no belts to wear or get out of line.

VIBRATION-LESS—smooth-floating multi-mounted compressor . . . dynamically-balanced fan.

TROUBLE-FREE—compressor hermetically-sealed against dust and moisture . . . no pulleys, couplings or seals.

NO ATTENTION NEEDED—pressure-type oiling . . . never needs replenishing.

LONG LIFE—compressor surfaces finished to micro-inch accuracy . . . oversize bearings . . . four rings per piston . . . dynamically-balanced crankshaft.

SAFE—high-pressure cut-out . . . high temperature safety switch.

CONVENIENT—finger-tip selection of temperature . . . thermostatic control . . . finger-tip adjustment of louvres.

ATTRACTIVE—plastic baked-enamel finish, scratch-resisting, washable . . . rounded corners, no projections . . . no "sweating".

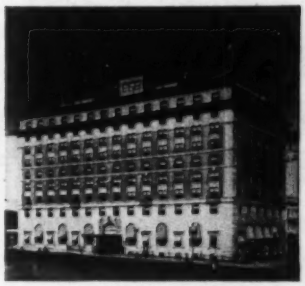
ECONOMICAL—thermally-insulated . . . large copper-finned cooling coils . . . Worthington Feather* Valves.

Each Worthington unit—3, 5 and 7½ ton sizes**—is built to the same high quality standards as Worthington equipment for engineered systems, such as those described at the right. *Write for Bulletin C1100-B29.*

*Reg. U. S. Pat. Off. **Also, for remote location: 7½, 10, 15, 20, 25 ton units

Another "Worthington-Conditioned" hotel

in the National Hotel Co. chain



The 400-room Washington Hotel, one of the leading hotels in the nation's capital, gets its air conditioning from a Worthington centrifugal refrigeration system, using chilled water. This is one of five National Hotel Company hotels to be Worthington-conditioned; the others are Hotel Jung, New Orleans; Travis Hotel, Dallas; Thomas Jefferson Hotel, Birmingham; Hotel Cortez, El Paso.

Off-and-On heat calls for Off-and-On cooling

The work performed in the research laboratory of Aluminum Company of America, East St. Louis, Ill., is of such a nature that excessive heat is produced intermittently.

Certain of the rooms are provided with a "wild zone" of air conditioning which goes into operation automatically when the heat-producing equipment is in use, and the normal air conditioning zone cannot handle the load.

This building is handled by a 125-ton Worthington air conditioning system comprised of two Freon-12 compressors and one evaporative condenser.

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

INVESTIGATE

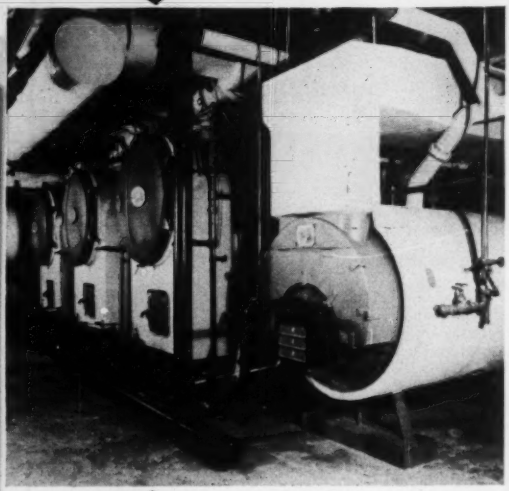
MORE WORTH WITH WORTHINGTON

Consult Classified Telephone Directory for nearest Worthington distributor. Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, N. J., specialists in air conditioning and refrigeration for more than 50 years. A1.3

For "Bedrock Economy" in HEATING and POWER

Choose and use

TITUSVILLE BOILERS



Compact, efficient layout distinguishes this Titusville boiler installation.

Here in the boiler room of the new Booker T. Washington High School in Shreveport, La., are shown three Titusville "Compact" Steel Heating Boilers (total rated capacity in excess of 36,000 sq. ft.), with a 30 H.P. Titusville "Wee Scot" marine boiler serving laundry and kitchen. The complete range of Titusville boilers enables many ideal service combinations. *Write us for details.*

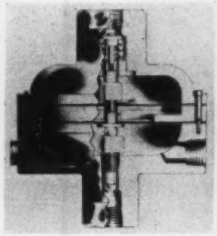
THE TITUSVILLE IRON WORKS COMPANY

A division of Struthers Wells

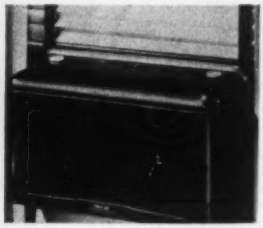
Representatives in Principal Cities

TITUSVILLE, PENNSYLVANIA

for delivering maximum pressure output at minimum pressure input from the controlling source, or vice versa, without modification in either pilot or valve hookup.



Relay



Conditioner

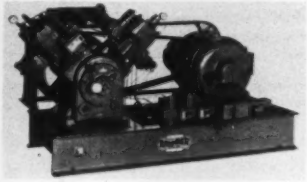
Window-Type Air Conditioner

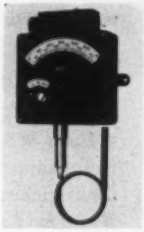
HPAC 23—A new 1 hp window-type room air conditioner is now in production at the plant of Mitchell Mfg. Co., 2525 N. Clybourn Ave., Chicago.

Features are said to include an improved "Dyna-Cooler" which insures the rapid flow of refrigerant through the cooling system, the "Turbo-Dryer" for removing moisture from the air, and the "Micro-Filter" which is said to remove over 99 percent of pollen from the air.

Refrigeration Compressor

HPAC 24—Brunner Mfg. Co., 1821 Broad St., Utica 1, N. Y., is now offering a 40 hp compressor, the R-40,000, for refrigeration and air conditioning service. It is pressure lubricated and equipped with a high pressure cut-out switch set for 175 psi. It can be equipped for unloaded start, and the same mechanism will afford four steps of capacity control. It is assembled at the factory either as a motor compressor, the E-40,000 (shown in photo), or as a complete condensing unit, the W-40,000.





Above: Compressor

Right: Thermostat

Thermostat

HPAC 25—United Electric Controls Co., 85 School St., Watertown, 72, Mass., has developed the "Type CI" indicating thermostat (liquid filled, remote bulb type) for temperature control in ovens, hot plate presses, water baths, incubators, proofing cabinets and other liquid, gas and metal-to-metal applications. The adjustable calibrated ranges have limits of −120 to 200 F, 50 to 350 F, and 50 to 600 F. In standard assemblies, bellows are brass, bulb and tube are copper. Head compensation is provided for changes in ambient room temperature and on-off differentials are fixed uniform throughout the range. Rating is 15 amp, 125 or 250 volts, a-c or d-c. Also available are

Good workmen + good tools + GOOD PIPE = GOOD JOB!

7 POINTS OF UNIFORM GOODNESS IN YOUNGSTOWN STEEL PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

WHEN your die is sharp and true, you enjoy cutting threads on Youngstown pipe. That's because it's so uniformly soft, so round and uniform in size. It has the toughness and strength, too, that make your threads full and well formed, clean and sharp. The name "Youngstown," rolled into every length, tells you it's GOOD PIPE.

QUALITY YOUNGSTOWN SERVICE

Youngstown STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY — General Offices — Youngstown 1, O.

Manufacturers of Carbon, Alloy and Yoloy Steel — Export Office - 500 Fifth Avenue, New York

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Alnor OFFERS YOU FOUR WAYS TO Save Time ...Save Money!

Time spent in needless rechecking, balancing and adjusting of heating and air conditioning systems is a waste. It can easily account for much of the cost on every installation and service job.

Here are four Alnor precision instruments that help you do a better job—faster, at lower cost. And like all Alnor instruments—in every industry—the ones shown here are favorites wherever precision and fine craftsmanship are essential.

ALNOR VELOMETER ... is a precision-built, self-contained, portable instrument that gives instant, accurate readings of air velocities anywhere. Needs no calculations or reference charts ... is direct reading. Available in wide scale range. *Write for Bulletin No. 2448-G.*

ALNOR THERMO-ANEMOMETER ... is a compact, simple instrument for reading air velocities as low as 5 f.p.m. It makes possible fast adjustment of velocities to bring utmost comfort ... efficiency. Drafts within rooms, flow from convectors, air flow in refrigerated spaces—all these and many more are ideal uses for this handy, direct reading precision instrument. *Send for Bulletin 913.*

ALNOR TYPE 2300 SURFACE PYROMETER ... sets a new high in precision measurement of low surface temperatures. Special design from Alnico magnet to finest, quick reacting thermocouple assures unfailing accuracy ... speed and dependability. Available in 5 Fahrenheit scale ranges with a span as small as 150°. *Send for Bulletin.*

ALNOR VELOMETER JR. ... ideal for taking a quick, accurate check on circulation and diffusion of air. Sturdily built, carefully calibrated, the palm-sized Velometer Jr. gives instant reading of air velocities without timing, reference charts, etc. *Send for Bulletin No. 725.*

Alnor **PRECISION INSTRUMENTS FOR EVERY INDUSTRY**

Illinois Testing Laboratories, Inc.
Room 513, 420 N. La Salle Street, Chicago 10, Ill.

Send complete information on the following:

☐ Velometer ☐ Thermo-Anemometer
☐ Type 2300 ☐ Velometer Jr.

Name.....

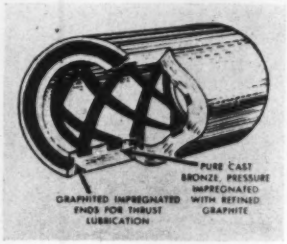
Address.....

City.....**Zone**.....**State**.....

centigrade calibrations, special heavy duty switches and dual switch arrangements.

Graphited Bearings

HPAC 26**—The new "Gopi" oil-less, graphited bearings and bushings developed by Bronze Bearings, Inc., 856 North Ave., E. Cranford, N. J. are recommended by the manufacturer for use where fluid lubricants might be inappropriate (where high temperatures might oxidize oil, etc.). The graphite composition is applied under pressure by hydraulic or other means, then baked at high temperatures for permanence. The manner in which bearings and bushings are impregnated with refined graphite is shown in the sketch. No further lubrication is required during the life of the bearing.



Bearing

Control Center

Electric Control Center

HPAC 27—The new "Multitrol" control centers of Ward Leonard Electric Co., Mount Vernon, N. Y., are designed for accommodating any control system up to 600 volts, using components not larger than NEMA size 5. Primary applications are for refrigeration and air conditioning systems, industrial plant machinery, generating plant auxiliaries and similar installations where a group of motors can be independently or interdependently controlled from a central location.

Prefabricated units containing control for a single motor are assembled and wired into a free standing steel enclosure section. Any number of sections may then be bolted and bussed together to form a control center. Units are available with magnetic full voltage starters, reversing or nonreversing; multi-speed starters; primary or secondary resistance starters; and autotransformer starters. Standard starters are equipped with externally operated circuit breakers, thermal overload protection and low voltage protection.

Control of Roof Sprinkler

HPAC 28—For use with a thermostat controlling its automatic sprinkler type roof cooler, April Showers, Inc., 4126 Eighth St., N. W., Washington 11, D. C., has developed an operator which is said to prevent spray water runoff, when set for maximum humidity, and which is designed to balance evaporation against the precipitation, thereby using all the water applied to the roof for solar heat removal.

The controller utilizes two needle valves which control the intake and discharge of water from a small copper tank. Connected to a brass float are cams which may be adjusted to vary the time period and the water used for each cycle of operation.

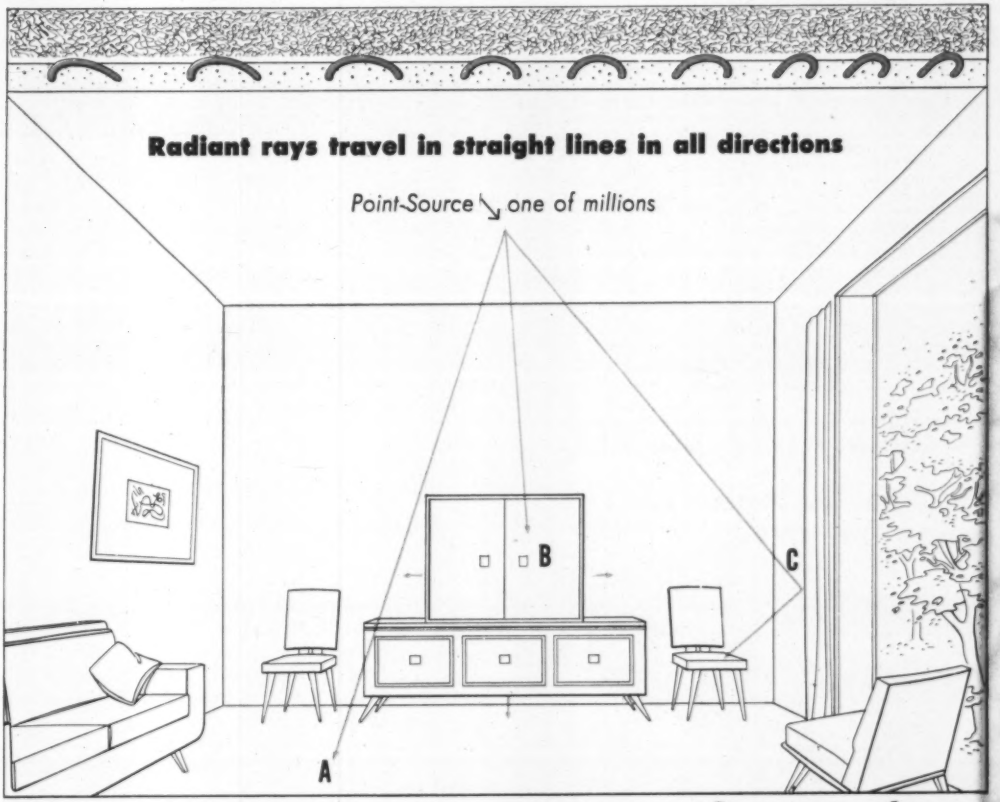
HOW TO EXPLAIN

RADIANT PANEL HEATING

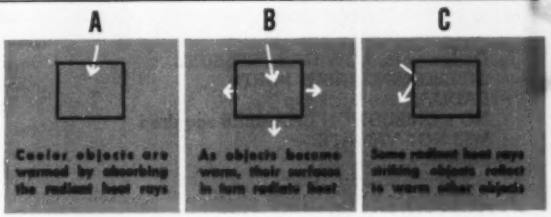
It works like rays of light

When you are asked how a radiant heating system warms a room, it may be simpler to explain if you think of the heat rays from radiant panels as being similar to light rays. The only difference is that they heat instead of illuminate every object they strike.

To simplify this illustration only a single point-source of heat is used. Actually, there are countless millions of such points on every radiant heating surface.



If you would like extra copies of this advertisement for your own use, we will gladly send them to you. Just let us know how many you would like. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.


A
B
C
Cooler objects are warmed by absorbing the radiant heat rays
As objects become warm, their surfaces in turn radiate heat
Some radiant heat rays striking objects reflect to warm other objects

nothing serves like

ANACONDA®

COPPER TUBES

NOTE: The use of copper and copper alloys is now subject to the regulations of The National Production Authority.

WEBSTER KINETIC* BURNER

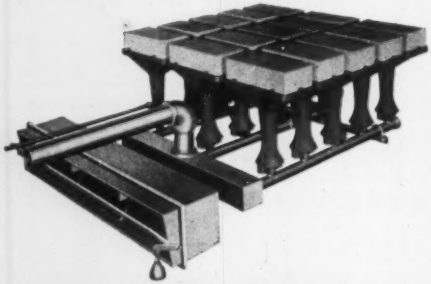
For Low Pressure Gas

The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

WEBSTER SERIES F 600 BURNER

For Low Pressure Gas



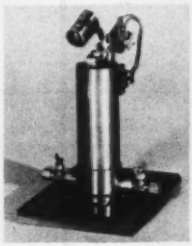
Designed for LOW GAS PRESSURE
INTERCHANGEABLE PORTS
RADIANT fire brick top
NO COMBUSTION CHAMBER required
Will NOT VIBRATE
LOW draft loss
ANY SHAPE and SIZE
INTEGRALLY MOUNTED pilots

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

The cams actuate a mercury switch which operates the sprinkler water valve. The intake valve also controls the time, and by partly closing this valve, the filling time for the small tank may be lengthened, thereby causing the sprays to remain on for a longer period. The second valve is used to empty the tank and the rate at which the water leaves the tank determines the period when the spray system is off, permitting the roof to dry between operating cycles. The operator is wired in series with the thermostat, and water to the operator is taken from the system side of the electric control valve.

The manufacturer recommends that an operator be used for each thermostat zone.



Sprinkler Control

pH Meter

Pocket Size pH Meter

HPAC 29—Analytical Measurements Inc., 585 Main St., Chatham, N. J., is now offering a new pocket size pH meter and companion probe unit.

Completely self-contained with batteries, the instrument is furnished in a case with plastic tubes of buffer and KCl solutions. The total weight is 3 lb. Supports and beakers are eliminated by combining the calomel and glass electrodes with the sample holder, in a single polyethylene probe unit. Combining the sample holder with the electrodes is said to completely protect them and to require a sample volume of only 0.5 ml.

The meter is scaled from 2 to 12 pH for easy reading, and a simple adjustment gives readings from 0 to 14. Accuracy of 0.1 pH is said to be obtainable. Hearing-aid type batteries provide up to 1300 hr of operation. The one-knob control and continuous reading features of the instrument are said to simplify operation for untrained personnel, and grounded samples can be directly measured because of no external power connections.

Power Roof Ventilator

HPAC 30—A new type PRV power roof ventilator for schools, hospitals, and commercial and industrial buildings is offered by Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago.

The unit is available in 11 sizes, each size offered in two to four different speeds. For extra quiet operation, low speeds are available in each of the 11 sizes. The backward-curved type centrifugal fan wheel is of the nonoverloading type and is directly connected to the self-cooled motor. According to the manufacturer, the unit features positive and controlled ventilation independent of wind or weather conditions and provides air deliveries over a range of pressures from free air to 1½ in. static. Positive pressure ventilation is provided to cool the motor and motor compartment with outside air. The

NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1951

SIMPLIFIES THE JOB TO SPEED INSTALLATION

THE unlimited economies of arc welding short-cut many costly and time-consuming operations in fabricating and installing pipe. Welded connections from 1¼" diameter and up are being produced at less cost than possible by other methods. Resulting solid high-quality welds assure permanent, trouble-free construction that is easier to insulate, clean or paint. In addition, other essential items such as hangers, base supports and brackets can be fabricated from pipe or simple steel shapes, speeding the work and cutting fabrication costs.

Fig. 3. Support for Water Lines. *Self-contained unit is weld-fabricated from pipe and plain steel straps. Saves need for individual hangers to speed installation.*

Fig. 5. Steam Header *built from 12" and 8" pipe has ends made from ¾" plate, beveled 45° and fillet welded to pipe with Lincoln "Fleetweld 5" electrode.*

Fig. 4. Base for Risers *is quickly built by flame cutting ordinary pipe and fillet welding to short bends. Has steel plate for bearing on concrete foundation.*

lays pipe faster

Fig. 1. Welds 45,000 Feet of Refrigerant Pipe. *Twenty foot sections of 1¼" pipe are first butt welded into eighty foot lengths on simple roll-type fixtures. "U" bends are then welded at ends giving permanent leak-proof construction.*

pressure-tight welds are easier

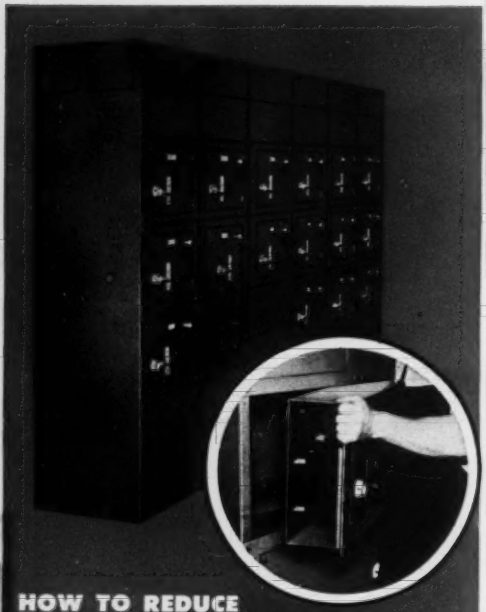
Fig. 2. Welds 8" High Pressure Steam Line *to valve coupling with 6 passes of 5/16" "Fleetweld 5" using Lincoln "Shield-Arc" welders. Joint is "U" groove using back-up ring.*

SEE HOW WELDING CUTS INSTALLATION COSTS

Send for Bulletin 403, "Welding Guide," write Dept. 282,

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 1, OHIO



HOW TO REDUCE
YOUR MOTOR CONTROL PROBLEM
TO ONE QUESTION—WHERE?

"Building-block" units permit grouping all motor controls at one point

You control *all* the motors in an entire area, floor or building—when you *centralize* the controls with Ward Leonard MULTITROL*.

Prefabricated MULTITROL units (each a complete control for one motor) fit into standard framework in any arrangement to suit the space. Units can be added, subtracted, interchanged, or relocated.

Some of the problems MULTITROL solves include: *Structural framework*—none needed, MULTITROL units are free-standing. *Obstructions*—no difficult cable or pipe forming, no chopping out walls. *Appearance*—no haphazard box mounting. *Safety*—completely deadfront construction.

Investigate MULTITROL. Wide choice of starter types, combined with externally-operated thermal circuit breakers. Write for Bulletin 4410. WARD LEONARD ELECTRIC CO., 24 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

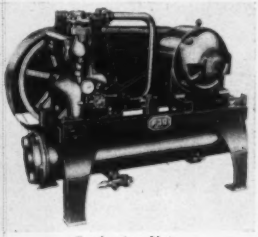
*Also available for D-C

WARD LEONARD
ELECTRIC COMPANY
Result-Engineered Controls Since 1892
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

weather-tight housing contains the complete fan unit and air control accessories.

Other features include a leakproof roof, hinged on two sides for inspection and assembly, an air shield separating the motor compartment from the air stream, floated drive sound isolation, and rainproof air discharge louvers on all four sides. Units have welded steel frames with galvanized iron sheathing, and an optional feature is sprayed-on insulation to prevent condensation forming on the inside of the housing.

Ventilator



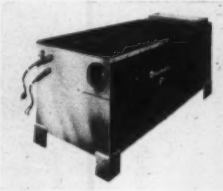
Condensing Unit

Refrigeration Condensing Unit

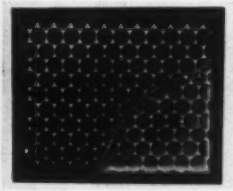
HPAC 31—A 10 and 15 hp water cooled condensing unit has been added to the line of Par Compressor Div., Lynch Corp., Toledo, Ohio. Designed for commercial refrigeration and air conditioning applications, it features v belt drive with a safety guard, dual pressure control, a magnetic starter with thermal overload protection, and a water regulating valve mounted on a heavy base. "Freon 12" is the refrigerant used.

Dehumidifier

HPAC 32—The new model 100 packaged dehumidifier of Dryomatic Corp., Alexandria, Va., is a three-channel continuous adsorption unit with plug-in automatic operation. There are no buckets to empty or chemicals to replace, and it is said to be effective in enclosed spaces up to 25,000 cu ft. According to the manufacturer, the unit will provide precise humidity control in a range of temperatures from −40 F to 100 F, and humidity levels as low as 15 percent can be maintained.



Dehumidifier



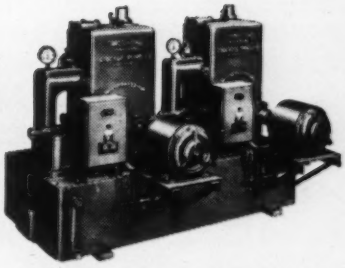
Air Filter

Air Filter

HPAC 33—Glasfloss, 155 E. 44th St., New York City, has developed a new I-S (impingement-strainer type) air filter to eliminate dust and dirt in central heating, ventilating and air conditioning systems.

It has the same standard impingement pad used in the company's regular line, to which has been added a bonded industrial mat placed on the downstream side of the filter. According to the company, 95 to 98 percent of all dust and dirt is trapped. The filter is recommended for use in

3 REASONS
Why Engineers Specify CHICAGO PUMPS



CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP

No vacuum on stuffing boxes, ample clearance in rotating members. It costs less to operate a Condo-Vac. Bulletin 270.

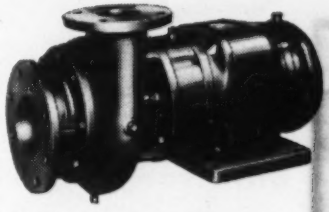
These are three sound reasons why more and more Engineers specify Chicago Pumps:

1. The Chicago Line is complete. There is a Chicago Pump for every service within the building. There's no division of responsibility —you can satisfy all your pump requirements through one central source.

2. Chicago Pumps embody the most advanced engineering developments. The know-how of over 40 years' specialized pump manufacturing experience goes into every Chicago Pump.

3. Chicago Pumps are constructed right. Their reputation for trouble-free, dependable performance has been justly won.

Many Engineers have adopted a Time and Dollar Saving Policy by Specifying CHICAGO —the Pumps for every building need.



TYPE "N" CLOSE COUPLED BOOSTER PUMP

Designed to handle the toughest pumping jobs efficiently and in the least possible space. Precision mechanical seal insures against leaking. Capacities up to 500 G.P.M.—Heads to 215 ft.

CHICAGO PUMP COMPANY
BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems

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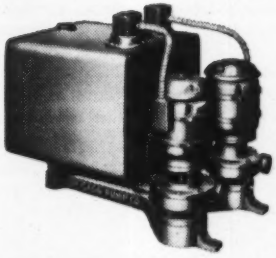
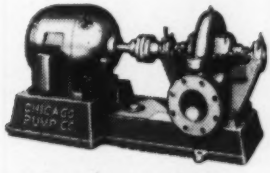
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.



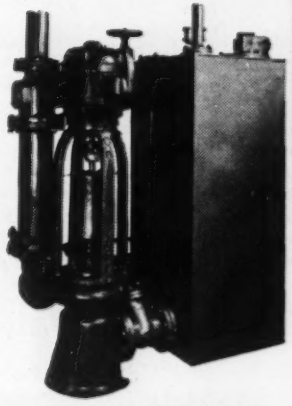
SURE RETURN CONDENSATION PUMP AND RECEIVER

Designed specifically to return HOT water to the boiler. It will not steam bind. Pump suction is always under head and suction opening is unusually large. Capacities up to 35,000 EDR and up to 50 psi. Bulletin 250.



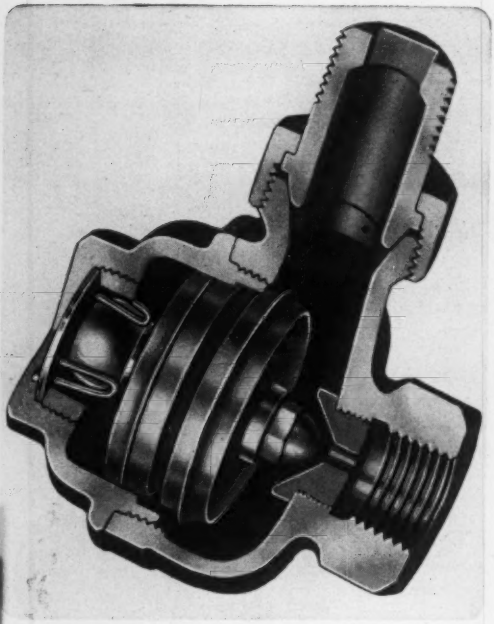
TYPE "D" DOUBLE SUCTION HORIZONTALLY SPLIT CASE PUMP

For House Pumps — Fire and Booster service. A ruggedly built pump for long trouble-free service. Capacities up to 1,900 G.P.M.—Heads up to 530 ft. Bulletin 101.



FLUSH-KLEEN SEWAGE EJECTOR

The only absolutely clog-proof ejector. Impellers handle nothing but strained sewage minimizing wear. Bulletin 122.



Built for Long Life in Medium and High Pressure Service

For steam pressures between 15 and 100 pounds gage, your safest choice is a B & J Medium or High Pressure Thermostatic Trap. These traps are especially effective for use with coffee urns, sterilizers, general cooking apparatus, process fixtures and laundry equipment where pressures exceed 15 pounds.

Heavily constructed, B & J Medium and High Pressure Traps are designed particularly for such uses. Removable stainless steel seat and monel valve piece, the only parts that will ever wear out — thermostatic element and seat — can be replaced quickly and easily.

And remember, too: every single item produced by Barnes & Jones is thoroughly and exhaustively checked and must pass our most exacting requirements before it ever leaves our plant. Moral: you're *bound* to be *right* with Barnes & Jones.

B&J

BARNES & JONES, Inc.
128 BROOKSIDE AVENUE, BOSTON 30, MASS.
Representatives in all principal cities

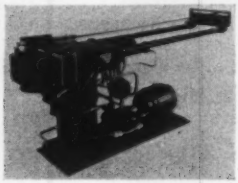
spray booth applications, food processing, pharmaceutical and soap manufacturing, television studios, restaurants, hospitals, schools, public buildings and institutions, etc.

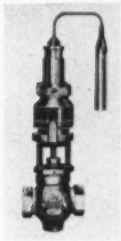
Bending Machine

HPAC 34—The new model 800 bending machine of Wallace Supplies Mfg. Co., 1300 Diversey Parkway, Chicago 14, is 21 in. wide, 34 in. high, 78 in. long, and is powered by a 2 hp, three phase motor.

It is operated by a single lever which, when pushed down, causes the bending arm to swing around to the degree of bend selected and to stay there until the operator has removed the bent part. The lever is then moved up and the arm swings back to its original position. According to the manufacturer, the machine can be changed quickly from a right hand bender to a left hand bender by changing the pressure and clamping arms.

This hydraulic unit is designed to handle IPS extra heavy steel pipe and tubing of 1.050 in. diameter and 0.154 in. thickness, stainless steel, annealed inconel, and similar alloys of 1 in. diameter and 0.065 in. thickness, aluminum and copper tubing (with a yield point under 12,000 psi) of 2 in. diameter and 0.093 in. thickness.





Above: Bender
Right: Regulator

Temperature Regulators

HPAC 35—A new calibrated dial for use with its class T and class M type temperature regulators has been developed by Leslie Co., 51 Delafield Ave., Lyndhurst, N. J.

The dial embodies several new features which are said to assure quick, easy and dependable temperature settings. According to the company, a turn of the dial to the desired setting is all the attention that is necessary. It is designed to provide protection against overheating caused by guess setting, and it is designed for long life under rugged operating conditions, such as production line use where frequent readjustments are necessary for process work. The dial fits in place of a standard adjusting sleeve.

Carbon Dioxide Indicator

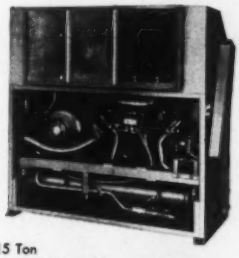
HPAC 36—A new CO_2 indicator is being manufactured by F. W. Dwyer Mfg. Co., 317 S. Western Ave., Chicago 12.

One of the most unusual features of the unit, says the company, is the fact that it takes but 20 sec to make a complete test, and over 500 tests can be made per refill. The body of the indicator is fabricated from transparent plastic bar stock. It has an open faced dial and each indicator is furnished with a circular type combustion efficiency slide rule. It is available in a metal

Now More Than Ever

It's *Curtis* for PROFITS

Because Most Installations are Within the Curtis Range — 2 through 40 Tons



10 and 15 Ton Complete CENTRAL TYPE

2 through 8 Ton PACKAGED UNITS (Shipped to you completely assembled)

Evaporative Condensers, Cooling Towers and Air Handling Units

With these units, you can handle any AIR CONDITIONING — REFRIGERATION or AIR MOVING JOB within this range — and when the job is sold, it *STAYS SOLD* because the QUALITY IS THERE. No corners have been cut in the manufacture of Curtis equipment — pound for pound, it's the best buy in the industry.

¼ H.P. through 40 H.P. Condensing Units.

Advertising Support A-Plenty

SATURDAY EVENING POST

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and many special consumer publications are pre-selling Curtis equipment to your prospects.

NOTE — A Curtis franchise may be open in your area. Write, giving full details.

97 Years of Successful Manufacturing

CURTIS REFRIGERATING MACHINE DIVISION

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7 ways to SPEED UP SHEET METAL WORK

3 ***BLACK & DECKER ELECTRIC PORTO-SHEARS**** cut sheet metal too tough for snips. Speed up jobs where snips are slow. Save you time and cut costs on hundreds of jobs. Fast, powerful shearing action eliminates hard muscular strain. Cutting operation *always* visible. Cut straight lines, irregular lines, curves to a minimum radius of ¾". Three models: 12, 16 and 18-gage capacity.

*Trade Mark Reg. U. S. Pat. Off

4 ***BLACK & DECKER ELECTRIC HAMMERS*** speed up such jobs as drilling holes for toggle bolts in concrete and brick—cutting mortar out of joints to install flashings—removing rust, weld spatter, old paint from sheet metal. High-speed, amazingly husky, deliver thousands of sharp, positive hammer blows per minute. Drive star drills, speed bits, chisels, many other tools. Light, compact, completely self-contained, require no transformer or extra equipment. Four models: rated by drilling capacity in concrete for ½", ¾", 1⅛", 2".

SEE YOUR NEARBY B & D DISTRIBUTOR for full details, expert help in cutting your costs. Write for free catalog to: THE BLACK & DECKER MFG. CO., 628 Pennsylvania Ave., Towson 4, Md.

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BD Black & Decker PORTABLE ELECTRIC TOOLS

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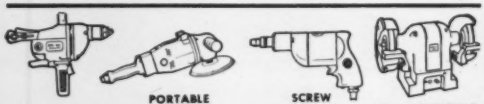
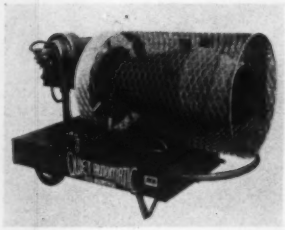


ELECTRIC DRILLS | PORTABLE SANDERS | SCREW DRIVERS | BENCH GRINDERS

case with provision for a stack thermometer, draft gage, and smoke tester.

Indicator



Heater

Space Heater

HPAC 37**—A new oil-fired model has been added to its line of portable, automatic space heaters by Quiet Automatic Oil Burner Corp., 33 Bloomfield Ave., Newark 4, N. J. The unit produces heat by both convection and radiation. The air, which is forced through the gun of the oil burner by a motor-driven axial blower, splits as it leaves the gun, part of it moving over the outside of the combustion chamber and part being used at the nozzle for combustion. Smoke and sparks are said to be eliminated through the use of a turbulator which is fitted to the gun. Burning No. 2 fuel oil (from an ordinary drum storage tank), the unit is rated at 200,000 Btu. It uses 110 volts, and operates by plug-in of the power extension line. Dimensions are 4 ft x 2 ft x 3 ft high.

Liquid Cooler

HPAC 38—A steel pipe nipple is now being welded to the cast steel refrigerant head on the "Dry-Ex" liquid cooler (with capacities up to 200 tons of refrigeration) produced by Acme Industries, Inc., Jackson, Mich. The new connection, designed to eliminate a previously inaccessible gasketed joint, is reamed out on the end to fit the OD of copper tubing. Since the test cap is silver soldered in place, it may be removed and the field connection made in one heating operation when a copper suction or liquid line is to be silver soldered to the chiller connection. Field connections may be made of steel pipe or tubing welded directly to the chiller nipple, which is previously scarfed for welding. Older flanged type connections will be furnished to balance out present inventories of machine castings.

Odor Counteractors

HPAC 39—Airkem, Inc., 241 E. 44th St., New York 17, is now offering a line of industrial odor counteractants which operate on the odor neutralization principle of opposing odors, and which are designed to combat odors in rendering and dehydrating processes and in similar applications. Each of the more than 40 "Reductor" formulas is compounded to meet a specific odor problem.

Millivoltmeter

HPAC 40—Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, has introduced an indicating millivoltmeter containing in the upper compartment a plug-in interchangeable galvanometer which is said to be easily serviced.

13 Sizes

300 to 20,000 CFM

Coil Face Areas From 1.1 to 32.9 SQ. FT.

For use with...

- **CHILLED WATER**
- **FREON**
- **STEAM**
- **HOT WATER**

Horizontal

Vertical

KENNARD *Engineered* AIR CONDITIONING BLOWER UNITS
Heating and/or Cooling

Available with—face and by-pass dampers, humidifiers, mixing boxes with dampers, etc. . . .

Representatives in Principal Cities

Write for name of nearest representative and complete information on Air Conditioning Blower Units—Finned Coils —Evaporative Condensers—Cooling Towers.

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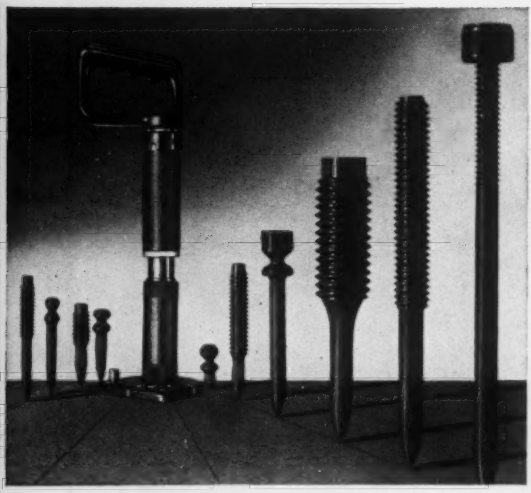

HOW TO PACK 480 MINUTES INTO 1 HOUR

You can do it, when you use RAMSET SYSTEM for the hundreds of fastening jobs required to install piping, duct work, controls and other heating and air conditioning equipment.

By old-fashioned methods of fastening into steel or concrete, 50 such jobs are a good 8 hours' work per man. Modern, high-speed RAMSET SYSTEM does at least 50 *per hour*—or 400 *per day per man*, under the same working conditions. That's packing 480 minutes into 1 hour, and cutting costs in proportion.

Just READY! RAM! SET!

The light-weight, portable, self-powered RAMSET TOOL does all the work. Just insert power charge and one of 76 alloy steel threaded studs or drive pins. Place the tool against the work and RAM! The fastener sets instantly, cleanly, permanently.

Ask for 15-minute demonstration

Let us *"Ramset"* a sample job for you, at no cost. That will prove the time-saving, money-saving, trouble-saving advantages which only RAMSET can deliver. To get your work finished faster and facilities into operation sooner, call your local RAMSET Specialist or write us.

Ramset Fasteners, Inc.
12117 Berea Road
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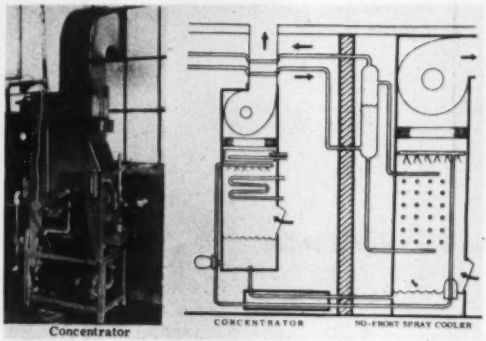
fasten FASTER with Ramset System
FASTENING SYSTEM
Pioneer in powder-actuated fastening

Designed for use in air conditioning, bakery, ceramic, metal and plastic industries, the unit can be actuated by thermocouples, pyrometers, tachometers, resistance thermometers or any source of millivoltage. It is said to be relatively free from the effects of vibration and from varying lengths of extension wires.

Low Temperature Frost Prevention

HPAC 41—Niagara Blower Co., 405 Lexington Ave., New York 17, has introduced new and improved "No Frost" equipment for refrigerating cold test rooms, cold storage spaces, etc.

The equipment consists of a spray cooler which provides a controlled cold air stream at sub-zero temperatures by means of passing air over refrigerated coils that are prevented from accumulating ice or frost by a constant spray of a special liquid having a low freezing point. The liquid is maintained in a concentrated condition by constantly removing the moisture that is condensed out of the atmosphere. This is done in a concentrator, now

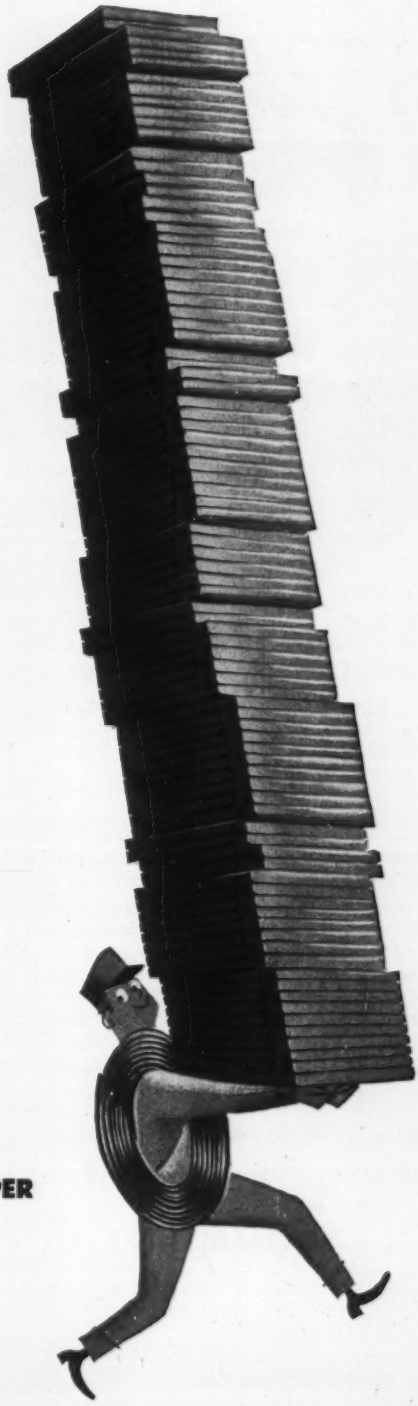


improved by the adoption of a completely new method utilizing newly designed apparatus. A portion of the liquid, as it is continuously being diluted by the condensation of water vapor, is pumped to the concentrator where it is sprayed into a chamber through which air is drawn by fans. A heating element raises the temperature of the air, promoting evaporation of water, which evaporates at a much higher rate than the liquid. In a second stage of re-concentration, the air stream, which now contains the evaporated water vapor and some liquid vapor, is cooled by a reflux coil. This, by increasing the relative humidity of the air stream, forces the condensation of the liquid vapor. The re-concentrated solution is returned to the spray cooler.

The new equipment is said to permit refrigeration to temperatures as low as −30 F without interruption for defrosting. From this point, additional refrigerant coils may be used to obtain extremely low temperatures.

Control for Heating Systems

HPAC 42—Types S-1 (single switch) and "S-2" (double switch) of the "Thermoray" (a temperature control unit sensitive to air velocity and surrounding surface temperatures) have been developed by Sarcotherm Controls, Inc., Empire State Bldg., New York 1. Used chiefly to control radiant heating systems, they are also applicable to steam and convector heating. A bellows actuated thermostat is contained in the units, which are heated by a resistor to



A Big Hit!

THE CHASE COPPER WATER TUBE CARTON

Now Chase Copper Water Tube comes in compact, sturdy cartons . . . easy to identify . . . easy to store.

In many sizes, the tubes are packed more than one coil to a box to reduce the carton disposal problem. And because it is clearly marked, you can pick your Chase Copper Water Tube Carton out of stock easily and quickly.

This is just another Chase service in line with the Chase tradition of providing the best in brass and copper.

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

• *The Nation's Headquarters for Brass & Copper*

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver†	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston†	Newark	Rochester†	(†Sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

"We can't go wrong—it's **radiant heated**"

Steel pipe is first choice for radiant heating

Among the thrills that come to all of us but "once in a lifetime", who does not remember that first Christmas together . . . or the baby's first birthday cake . . . or the first brand-new, shining car?

But the biggest thrill of them all came when, hand in hand, we stood before that just purchased home-of-our-own!

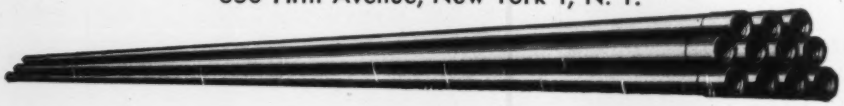
Young folks today (and older ones, too) face the same moments of decision that we did when buying or building a new home. But, when they find their dream house is to have Radiant Panel Heating, they know it was designed by those acquainted with the latest in home building ideas. Radiant Heating becomes a symbol of sound value!

And when the Radiant Panel Heating coils are of Steel Pipe, success is assured. For Steel Pipe has all the desirable characteristics of durability, weldability, formability, and maximum economy . . . proved through more than 60 years of service in domestic heating systems!

Steel Pipe coils for Radiant Panel systems may be used with equal effectiveness in floor, wall, or, as shown above, ceiling installations.

A 48-page color booklet "Radiant Panel Heating with Steel Pipe" is yours for the asking. Write for it . . . it's free.

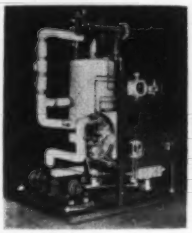
COMMITTEE ON STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N. Y.



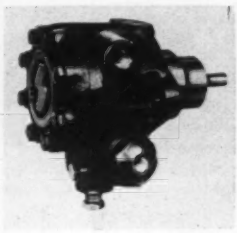
keep the outside surface at approximately body temperature. When operative temperature increases, less heat is given off by the surface. Temperature inside the surface then expands the bellows liquid, causing the thermostat stem to press against a switch which will open or close a circuit. The reverse occurs when operative temperature decreases. Both types have a temperature range of 55 to 85 F, 115 or 230 volts, 5 or 10 amp, ¼ hp.

Heat Transfer Unit

HPAC 43*—A new standard line of electrically heated heat transfer units (supplied complete with instruments, piping, insulation and other accessories) is now available from Struthers Wells Corp., Warren, Pa. The units have capacities ranging from 100,000 to 500,000 Btu per hr and are said to have a temperature range to about 750 F using "Dowtherm" as a liquid or vapor medium. Other heat transfer fluids may be used. The manufacturer states that a special heating element included is designed to eliminate thermal breakdown or coking troubles.



Heat Transfer Unit



Pump

Oil Burner Fuel Pumps

HPAC 44—The new J and K model fuel pumps of the fuel unit and industrial hydraulic divisions of Sundstrand Machine Tool Co., Rockford, Ill., were on display at the recent exposition of the Oil Heat Institute.

The outstanding feature of the new designs, says the company, is the adaptability of just two models, with and without solenoids, for virtually all new equipment or replacement applications. Capacities range up to 20 gph and strainers are of improved construction, can be readily removed, and can be installed without removing the pump from the burner. The company's "Rota-Roll" pumping principle has been retained on both units and a further reduction in noise level is said to be accomplished with a new anti-hum diaphragm and hydraulically equalized pumping members. Valves may be readily adjusted for a pressure range of 75 to 150 psi and are designed for rapid servicing or replacement in the field.

Flow Regulating Stop Cock

HPAC 45**—The new flow regulating valve of Reynolds Shaffer Co., Detroit 4, is a stop cock designed for use where control of the flow of water or other liquids is required. It can be used as a flow regulating valve for jet pumps and spray pumps, as a bypass valve on boiler feed lines, and in any place where a quick opening, easy-operating flow regulating valve or stop cock is needed

Offered in the ¾ in. pipe size, it is available in two models; one has a port area equal to 1 in. pipe, and the

For Measuring...

AIR VELOCITY

THE *HASTINGS* AIR-METER

SO SMALL IT FITS IN THE PALM OF YOUR HAND*

IDEAL FOR:

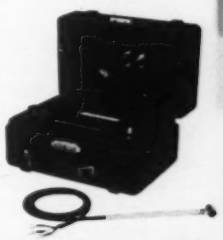
- Laboratories
- Schools
- Air Conditioning
- Heating
- Inspection Work
- Gas Flowmeter
- Anywhere air or gas velocities are to be measured

The HASTINGS AIR-METER is ideal for measurement of air and gas velocities from a low of 5 feet per minute up to 6,000 feet per minute. The instrument's unique principle of operation eliminates the effect of temperature and rate of temperature change. It is not affected by normal atmospheric pressure changes. A compact unit that weighs only 24 ounces. May be operated from a 110 V, 60 cycle a-c outlet or from a battery pack.

*Adaptable to standard extension cords

ALSO THE HASTINGS PRECISION AIR-METER

Developed for field or laboratory use where extreme sensitivity and stability are required. Operates on same principle as standard Air-Meter. Easily adapted for use as a flowmeter or with remote recording or indicating instruments. Reading indicator lag is less than one second. Other special probes available. WRITE TODAY for complete data on both Air-Meters.



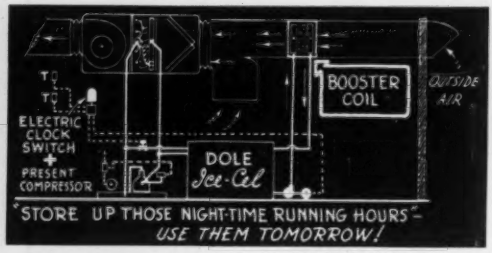
HASTINGS INSTRUMENT COMPANY, INC.

HAMPTON 7, VIRGINIA

DESIGNERS AND BUILDERS OF RAYDIST AND SPECIAL ELECTRONIC, ELECTRICAL, AND MECHANICAL INSTRUMENTS

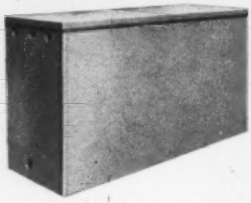
40% *MORE* CAPACITY

with DOLE *Ice-Cels*



DOC DOLECO Says —

DOLE Ice-Cels can be used singly or in batteries to provide any desired cooling capacity.



Many air conditioning systems — especially in older buildings — are seriously overloaded and additional capacity is unobtainable without replacement of the present compressor by a larger machine and major changes in the installation. You can avoid costly remodeling by using DOLE Ice-Cels with **present** equipment and get up to **40% more capacity.**

The diagram above shows how a DOLE Ice-Cel can be installed and hooked into the system as a booster. An electric clock switch is arranged to operate the compressor far into the night to charge the Ice-Cel. Then, during peak hours the following day, this stored up cooling power is available to augment the regular capacity of the compressor.

Write for prices and complete engineering data on DOLE Ice-Cels as boosters for installation in **your** territory.

DOLE manufacturing facilities including modern machinery and experienced personnel for sheet metal working are available for handling Government orders. We invite your inquiries.

DOLE Vacuum COLD PLATES — REFRIGERATION PURPOSES

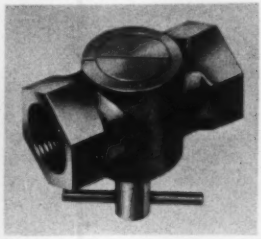
DOLE REFRIGERATING CO.

5918 N. Pulaski Rd., Chicago 30, Ill.

103 Park Ave., New York 17

44 Elgin St., Brantford, Ont.

other has a ¼ in. port for fine adjustments so it may be used in place of a needle valve. Features are said to include "finger tip" operation, all brass construction, and the use of O ring packing designed to withstand virtually any pressure.



Stop Cock

Meter

Air Velocity Meter

HPAC 16—The new "Agitair" air velocity meter is a battery operated instrument especially designed for use in connection with heating, ventilating and air conditioning. The manufacturer is Air Devices, Inc., 17 E. 42nd St., New York 17.

Based on the hot thermopile principle, the instrument is said to give accurate, instantaneous readings of velocities as low as 5 fpm and as high as 4000 fpm, with static pressure readings from 0 to 4 in. of water.

Said to be unusually light in weight, simple in operation and compact, it is recommended for many diverse applications.

Gas Heating Control System

HPAC 47—Minneapolis-Honeywell Regulator Co., 2604 Fourth Ave., S., Minneapolis 8, is marketing a new automatic control system for gas fired heating systems. Designed to eliminate chilly floors and overheating, the system utilizes a thermostat of improved design and sensitivity. It regulates the frequency of burner operation so that heat is provided in relatively small portions in mild weather and in progressively larger amounts as the temperature drops.

Also featured in the new control system is a specially designed diaphragm gas valve which is said to be virtually soundproof. The diaphragm is operated by an integrally mounted relay type controller with a small, three-way pilot valve.

The gas control package is available either in plug-in transformer or plate-mounted transformer models.

Fuel Oil Detector and Preheater

HPAC 48—The "Yula-Trol" is a fuel oil detector and safety device to be used with the model YT preheater of Yula Water Heaters, Inc., 166 W. 225th St., New York 63.

The equipment consists of a U tube preheater with a coupling on top of the shell, provided to receive a probe fitting and a special oil de-entrainment chamber on the bottom of the shell. In addition to a sensitive probe with a special probe fitting, the equipment includes a relay box equipped with red and green lights and an alarm bell.

Use your complete, up-to-date January Directory Issue of

Heating, Piping & Air Conditioning

for SPECIFICATION *and* BUYING INFORMATION

The time you spend in looking up sources of supply for the products you need for your jobs is money spent . . . just the same as though you dipped into your pocket and paid it out. One dependable way to find what you are looking for *in a hurry* is to keep the January Directory issue of Heating, Piping & Air Conditioning constantly available for ready reference. You'll find an accurate and up-to-date listing of products alphabetically arranged, along with their identifying trade names and company addresses in the yellow section of this complete buying guide. Boilers, instruments and controls, registers and grilles, pumps, valves, traps, compressors, specialties of all kinds, etc., are listed and the manufacturers who advertise in this issue are prominently identified in the event you might want to refer to their advertisements for more information.

Keep it right at your elbow . . . when you need any item connected with heating, piping, and air conditioning, make it a habit to pick up the January Directory issue and easily find who makes it and where they're located.

HEATING, PIPING & AIR CONDITIONING
6 North Michigan Ave. Chicago 2, Ill.

. . . here's what other engineers and contractors have to say . . .

"Your Directory issue is an excellent buyers' guide. We use it a great many times during the course of the year."
BOSTON ENGINEER

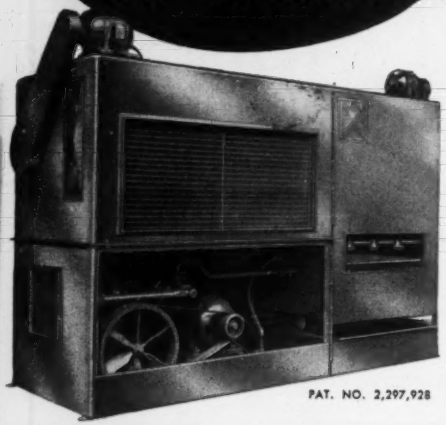
"We find both Directory and Advertising Section helpful. The advertising gives us the product details we need."
CHICAGO CONTRACTOR

"Your directory stays in this office until the next January issue comes along. Numerous times we refer to it."
FORT WAYNE CONTRACTOR

"In our work, we make use of your Directory time and time again. Our reference file would not be complete without it."
LOS ANGELES ENGINEER

REMEMBER — EVERY product is right at your fingertips

For day in, day out
DEPENDABILITY
you can't beat a
GOVERNAIR
COMPLETELY PACKAGED
AIR CONDITIONER

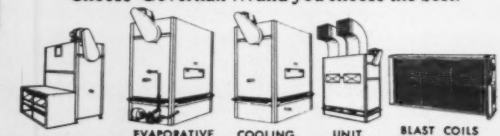


PAT. NO. 2,297,928

Name your job . . . any air conditioning job requiring from 3 to 50 tons . . . and you'll find that you can't beat a Governair system for day in, day out dependability.

Governair Packaged Air Conditioners are designed to operate at peak efficiency—with all parts precision-matched to work together. And they're built to give years and years of low-cost, trouble-free service.

Choose Governair . . . and you choose the best!



AIR CONDITIONERS | EVAPORATIVE CONDENSERS | COOLING TOWERS | UNIT COOLERS | BLAST COILS FOR HEATING AND COOLING

GOVERNAIR

Standard units are furnished for 220 volt, 60 cycle, single phase relay contacts rated at 10 amp. Units for 110 volt, 60 cycle, single phase operation can be furnished on special order.

Fluid Flow Controller

HPAC 49—A compact and lightweight transmitter, designed for sensitive measurement and control of fluid flows in many industrial processes, is now available from Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44. The new unit, called a differential converter, has a continuously adjustable range from 0-20 to 0-200 in. of water (differential pressure) and provides this 10 to 1 change of range with no change of parts. Field calibration of any range is possible by the use of scale-type weights which eliminate the need for a water column.

Operating on the pneumatic-balance principle without mercury, the unit employs a weigh-beam system in which the differential pressure, due to fluid flow at a metering orifice, is continuously balanced by a pneumatic pressure. This pressure becomes a measure of the fluid flow and is connected to a recording or controlling instrument. Extremely fast speed of response to rapid changes in flow is said to be the prime feature of the system.

The forged body of the unit is offered with a 750 or 1500 psi rating in type 316 stainless steel or carbon steel.

Oil and Water Heater

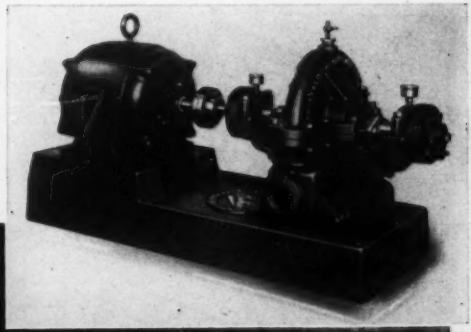
HPAC 50—The "Chromalox" electric circulation heaters produced by Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, are now available in new larger sizes. The 40 kw size can be used for preheating regular fuel oil to about 170 F. (Such oil-fired installations can be used in heating ovens, kilns, etc., and in central heating systems for large buildings.) Similar heaters can be used for preheating Bunker C oils, and for heating "Dowtherm," "Prestone" solution, etc., when connected to large process kettles and other equipment. The same style heaters in 50, 75 and 100 kw size are recommended for heating large quantities of water. Heating elements are generally alloy sheath, but copper sheath is used for heating water. Baffles are provided in the housing for operation under forced circulation.

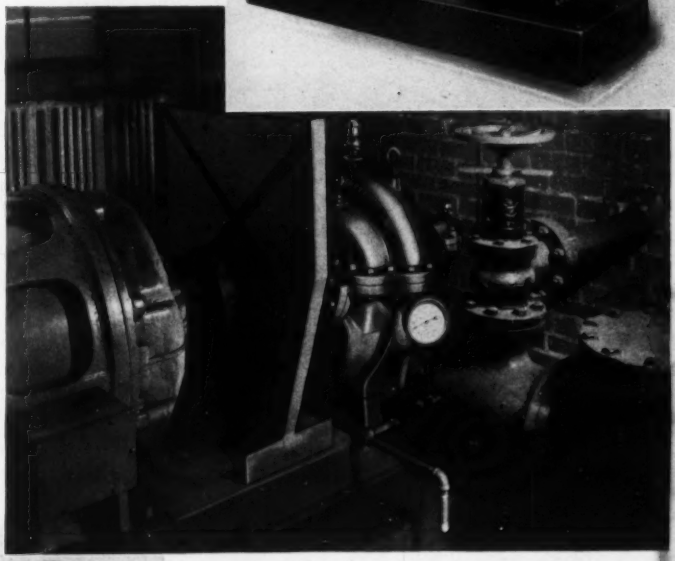
WE HEAR THAT . . .

This year marks the 100th birthday of *TAYLOR INSTRUMENTS COMPANIES*, Rochester, N.Y., which started out as a small partnership for making household thermometers and barometers, and has become a multimillion dollar corporation manufacturing some 8,000 variations of its basic products, which have a world-wide distribution..... *ALUMINUM CO. OF AMERICA*, Pittsburgh, will begin construction immediately on a new aluminum smelting plant (capable of supplying 170,000,000 lb of aluminum annually) at Wenatchee, Washington.

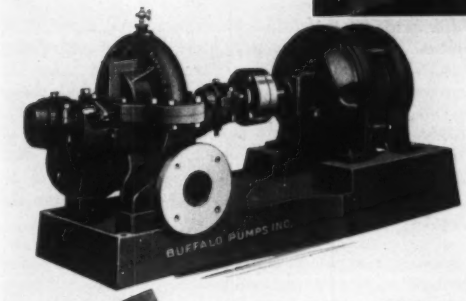
Twenty former *GENERAL ELECTRIC CO.* engineering and sales experts will come out of retirement for three months to become exhibit engineers on the firm's "More Power to America Special" exhibit train, as it completes a 30,000 mile tour of the nation's industrial centers..... The *HEAT TRANSFER DIV., NATIONAL RADIATOR*

For the Economy of Trouble-Free CLEAR WATER PUMPING





"Buffalo" "SL" PUMPS



WRITE FOR BULLETIN 955-N!

IN SIZES FOR 10 to 10,000 GPM AND FOR HEADS UP TO 300 FEET

"Buffalo" Single Stage Double Suction Pumps are performing every type of clear water service in industry — and doing it so efficiently and with so little maintenance care that economy is always the result. Upper half of the pump casing is easily removed for impeller inspection without disturbing pipe connections, making for inexpensive servicing. The efficient "Buffalo" impeller is in perfect hydraulic balance — while casing water passages are simply formed to avoid friction losses. Shafts, casings, impellers, bearings and pump stands are all oversize for long-life insurance. Specify "Buffalo" Pumps and you'll get the economy of trouble-free pumping.

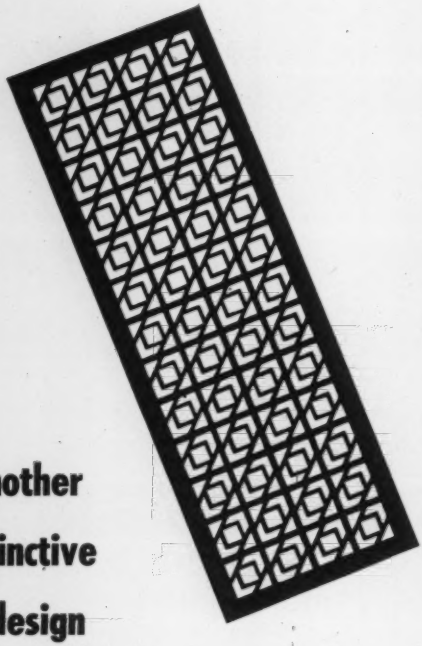
"Buffalo" PUMPS

BUFFALO PUMPS INC.

171 MORTIMER ST. BUFFALO, NEW YORK

Canada Pumps, Ltd., Kitchener, Ont.
Branch Offices in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



another distinctive design of Ornamental Grille

This attractive grille, M No. 7, is obtainable only from Hendrick, as it is one of the exclusive designs Hendrick originated and patented.

Hendrick offers a selection from over a hundred standard designs, and whatever the decorative motif of a building, or a room, a grille design to harmonize with it can readily be found. Each design is available in a wide range of overall dimensions, bar sizes, and number and sizes of perforations. Ample open areas assure good air flow.

Hendrick ornamental metal grilles have a well-earned reputation for perfection of construction. Sizes are accurate, perforations clean-cut, and there are no burrs or other imperfections. Installation is easy, because a special flattening operation in their manufacture gives the grilles uniformly flat sufaces.

Write for full information.

SEE OUR CATALOG IN SWEET'S

Perforated Metals
Perforated Metal Screens
Wedge-Slot Screens
Architectural Grilles
Mitco Open Steel Flooring,
Shur-Site Treads, Armorgrids

HENDRICK
Manufacturing Company
48 DUNDAFF STREET, CARBONDALE, PA.
Sales Offices in Principal Cities

CO., Johnstown, Pa. has appointed *JACKSON ENGINEERING CO.*, 6144 Ferguson Drive, Los Angeles, as its sales representative for Southern California.

WARREN WEBSTER & CO., Camden, N.J., has begun construction on a 2-story extension to its plant, to be used for the production of boosters, an ammunition component which the company manufactured during World War II, and which now will be produced under a contract awarded recently through the Philadelphia Ordnance District. Manufacture of the ordnance will be carried on simultaneously with production of the company's line of heating equipment for both defense plant and civilian use.

At the recent annual convention of The American Institute of Architects, 28 building products manufacturers and trade associations were commended for excellence in their technical and promotional literature (prepared for the guidance of architects). *BELL & GOSSETT CO.*, Morton Grove, Ill. was awarded a certificate of merit for a handbook, and *ANEMOSTAT CORP. OF AMERICA*, New York, received a certificate of honorable mention for a bulletin on ceiling architecture.

An increase of 321% for 1949-50 over the preceding year's sales was announced by *REMINGTON CORP.* at a recent week-long sales forum held at the company's plant in Auburn, N.Y. According to *E. A. BONNEVILLE*, sales manager who conducted the meetings, an even sharper rise in sales of the company's standard ½ to 1½ hp units is anticipated for the coming year. Stating that air conditioning is still in its infancy, he quoted as the industry's potential an annual market comparable to that of domestic electric refrigerators.

LT. ROBERT WIRTH, assistant purchasing agent, *C. A. DUNHAM CO.*, Chicago, was given a "send off" dinner recently by members of the Purchasing and Sales Departments, on the eve of his departure to assume his duties on the U.S.S. Hancock..... *WEIL-McLAIN CO.*, Michigan City, Ind., has announced the retirement of *CHARLES F. NEWPORT*, who has been with the company for 26 years. He is well known for his part in designing a magazine-feed type boiler popular before the advent of automatic boiler firing.

31 additional patents and applications for patents owned by the U.S. Government and held by the Atomic Energy Commission recently have been released for public use, bringing the total number of such releases to 240. The Commission will grant non-exclusive, royalty-free licenses, for which applicants should apply to *CHIEF, PATENT BRANCH, OFFICE OF THE GENERAL COUNSEL, U.S. ATOMIC ENERGY COMMISION*, Washington 25, D. C.

Among the patents released is No. 2,536,602, an automatic flange system invented by J. J. Goett, Chicago. The device is used for opening, closing, and sealing pipe joints and junctions by remote control, and it utilizes a flange provided with hydraulic clamps fastened to one of the pipe sections and capable of clasping a flange on another pipe section when actuated from a remote location.

RICHARD S. DAWSON CO., 228 Glendale Blvd., Los

The light in the "Lab"

In the research laboratories of hospitals, clinics, and medical schools throughout our country, the lights burn late . . . as scientists constantly strive to halt humanity's greatest enemy—CANCER.

As the lights continue to burn, the hope for a cure grows brighter . . . here's why:

Cancer Research Is Paying Off

Through research—which you have helped to support by donating to the American Cancer Society—medical science now has new weapons to combat this disease more effectively than ever:

Drugs—there is evidence that a chemical treatment for cancer may be perfected. Certain drugs will prolong the lives of cancer victims . . . other promising compounds are being tested.

Hormones—treatment with hormones, such as ACTH and Cortisone, has brought about dramatic, although temporary, effects in some types of cancer. Other hormones have helped control *advanced* cancer of certain organs.

X-rays—the development of more powerful machines promises to make this form of treatment more effective.

Isotopes—radioactive chemicals are becoming increasingly useful in treating certain rare forms of the disease.

In addition, surgical technics have been improved so much that once hazardous operations can now be performed safely. And progress is being made in the development of tests to detect cancer in its earliest stages when the chances for cure are best. Research has made these life-saving advances possible. But, as long as cancer continues to kill some 210,000 men, women, and children in our country each year, we *must* keep the lights burning in the laboratories! *Much more research needs to be done before cancer can be dealt the final blow!*

Your life—the life of everyone you know—is at stake. Give generously to the 1951 Cancer Crusade.

Help Science Help You . . . Give To Conquer Cancer

Mail your contribution today to CANCER % Your Local Post Office

. . . your gift will reach your American Cancer Society Division

CANCER,
care of Your Local Post Office

Here is my contribution of $_____ to fight Cancer.

Name _____

Address _____

City _____ Zone _____

State _____

Angeles, has been appointed California sales representative for *COOLING EQUIPMENT DIV., BINKS MFG., CO.*, Chicago..... *YORK-SHIPLEY, INC.*, York, Pa., has established a defense order division which will be managed by *JOHN G. KEARNS*, vice president in charge of production. *DONALD J. NORBECK*, purchasing agent, is the new director of purchases and assistant general production manager, and *ROBERT B. DUNDORE* has been promoted to the post of purchasing agent.

At the request of the Economic Cooperation Administration, the *AMERICAN STANDARDS ASSOCIATION* is inaugurating a survey of American industry to determine the amount of money saving which results from adoption of standards in industry. The ECA needs such evidence to support its program for increased production in the Marshall Plan countries. All kinds of standards will be covered, whatever their origin (trade associations, technical societies, private companies, etc., as well as the ASA). The ASA is asking its more than 2200 member bodies, associate members and company members to participate by supplying specific data.

Several new franchise distributors for its line of air conditioning equipment have been appointed by *AUTOMATIC FIRING CORP.*, St. Louis. *CAROLINA SALES*, Greenville, N.C. and Columbia, S.C., *MOORE & STEWART*, Gastonia, N.C., and *ALAMO DISTRIBUTING CO.*, San Antonio, will handle room coolers, packaged air conditioners and a combination heating-cooling unit. Room coolers will be distributed by *MYTELKA AND ROSE*, Newark, N.J., and *TEXAS WHOLESALERS, INC.*, Dallas, Texas.

To study the effects of room air conditioning on the human body, *MITCHELL MFG. CO.*, Chicago, has established *THE MITCHELL AIR-CONDITIONING RESEARCH FOUNDATION*, a non-profit organization. Initial experiments will be carried out at Michael Reese Hospital, Chicago, and will concentrate on the effects of an air conditioned atmosphere on healthy and failing human hearts.

THE BUILDING RESEARCH ADVISORY BOARD has secured authorization from its parent organization, the *NATIONAL ACADEMY OF SCIENCES — NATIONAL RESEARCH COUNCIL*, for creation of a supporting organization, the *BUILDING RESEARCH INSTITUTE*, which will provide membership from the building industry, and will act as liaison agency working for closer contact between the board and all those interested in building research.

Two station wagons have been completely fitted for field demonstrations of its line of gas and oil heating units by *NORMAN PRODUCTS CO.*, Columbus, O. One of the sales cars will cover the Atlantic Seaboard, the other, the midwest area..... A permanent cartridge demineralizer (with a sight indicator which enables the operator to adjust rate of intake flow) is now available from *PENFIELD MFG. CO.*, Meriden, Conn., for users of up to 10 gph of high purity water. It is installed on the wall near the tap.

QUICK PROFITS . . . EASY INSTALLATIONS . . . SATISFIED CUSTOMERS

when you go after

REPLACEMENTS and CONVERSIONS

with

BANKHEAT BURNERS

Now is the time to replace oil wasting burners with a Bankheat. It's the easiest selling that you can do today . . . selling that will make you a profit, and a new set of satisfied customers.

Bankheat Burners have an unequalled reputation for oil-saving efficiency. In thousands of homes they are powering boilers, boiler burner units and water heaters. For many years in many lands they have been building up a record of economical performance. They're fully automatic, precision built, easy to install, exceptionally dependable. They are today's best bet for dealers who want sales. May we send you the full story?

There's an automatic Johnson Burner for EVERY heating need.

Johnson Oil Burners

Builders of fine Oil Burner Equipment since 1903

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
401 No. Broad St., Philadelphia 8, Pa.

PRODUCTS PLANNING CO., Pittsburgh, has developed a formula of special, blended aggregates which, when added to concretes, increases heat conductivity and so cuts down on pipe requirements (and costs) of radiant heating installations. The formula may be added to other plastic masses and is said to increase the wearing qualities of commercial grades of concrete.

"MSA Carbon Monoxide Recorders," a development of *MINE SAFETY APPLIANCES CO.*, Pittsburgh, will be installed to analyze air samples from the new Squirrel Hill tunnel on the Penn-Lincoln Pkway., in Pittsburgh. The instruments, designed to detect one part of the gas in a million parts of air, will continuously record percentages present. Air samples are drawn from the tunnel to the instruments, which are in the ventilation building. When concentration approaches a predetermined limit, ventilating equipment supplies more air to the tunnel. In this way, the instruments conserve power used in ventilating equipment motors.

CHAS. J. RILEY & SONS, Chicago, specialists in conservation of tanks, bunkers, and other surfaces, have opened an eastern office through their association with *WM. J. O'BRIEN* of the *O'BRIEN STEAM SPECIALTY CO., INC.*, 301 Hefferman Bldg., Syracuse 2, N.Y.

In recent tests undertaken by Mason-Neilan Regulator Co., Boston (to guide selection and design of diaphragm motors for automatic control valves), valve stem forces were measured by means of the SR-4 resistance wire strain gages of *BALDWIN-LIMA-HAMILTON CORP.*, Philadelphia. Accuracy of the equipment was reported as being beyond that required for the tests.

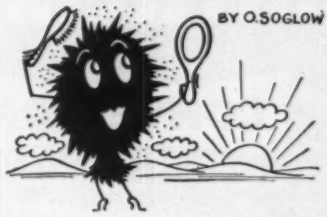
200 university and industrial scientists assembled recently for the dedication of the new laboratories which have been added to the Experimental Station of *E. I. du PONT de NEMOURS & CO., INC.*, Wilmington, Del. With the expansion, the station is large enough to house nearly half the company's research personnel.

Visitors toured the engineering research laboratory, where they were shown studies of corrosion problems in chemical manufacturing, design of distillation equipment, and the behavior of construction materials in high-pressure synthesis plants. Featured was the first public disclosure of a sand-derived material, "GS" silica, which some day may be used as a thickening agent to produce grease with unusual resistance to heat, water and mechanical breakdown. An experimental cloth which will not burn at temperatures as high as 1400 F also was shown for the first time.

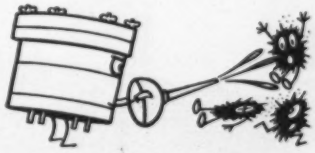
AIR DEVICES, INC., New York, has appointed the *ROY O. NELSON CO.*, Chicago, as representative in the area for its filters, diffusers and exhausters..... *O. K. McCULLOUGH*, sales engineer, has been appointed Kansas City territory representative of the air conditioning compressor line of *SCHNACKE, INC.*, Evansville, Ind.

PITTSBURGH CORNING CORP., 307 Fourth Ave., Pittsburgh, has developed the "Clean-Easy" glass block face finish for all PC-55 line functional glass blocks. The new factory applied, transparent face finish is designed to

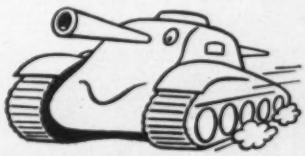
AIR-MAZING FACTS



DUST CAN BE BEAUTIFUL! Airborne dust—often a nuisance to industry—is also the cause of one of the most spectacular beauties of nature! Fine dust particles in the atmosphere reflect some colors of the sunlight more strongly than others—give us our colorful sunsets.



STOPS DUST WITH OIL! Air-Maze oil bath filters literally "scrub" intake air in a pool of oil. Used on large diesel engines and air compressors, they keep damaging dust and dirt from moving parts.



KEEPS SHIFTLESS TANKS ON THE GO. Automatic transmissions in the newest Army tanks use Air-Maze oil filters to remove trouble-causing abrasive dirt from the oil. Air-Maze liquid filters provide many times more net effective filter area than other permanent types.

WHETHER YOU BUILD OR USE engines, compressors, air-conditioning or ventilating equipment, or *any device using air or liquids*—the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities, or write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE

The Filter Engineers

AIR FILTERS
SILENCERS
SPARK ARRESTERS
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

■ Designed for Quick, Easy Installation

AIRTHERM

CONVECTORS

Attractive appearance, outstanding performance, and ease of installation have led to an increasing preference for Airtherm Convectors in institutions, apartments, homes and schools. Try AIRTHERM Convectors on your next job.

Airtherm Cabinet design permits quick, easy assembly.

FREE STANDING RECESSED

FOR HEATING SATISFACTION...
Think First of AIRTHERM

AIRTHERM MANUFACTURING COMPANY
711 SOUTH SPRING AVENUE • ST. LOUIS 10, MISSOURI

cut in half the time required to clean away mortar smears on the block face during panel construction, provide a clean block face, and make it possible for occasional rainfall to clean the exterior of the glass block panel.

FLEXROCK CO., Philadelphia 4, has developed a series of new nonmelting waxes which are expected to have wide application in many industries. They are already being used in the mechanical packing field. According to the manufacturer, even if heated to the combustion point, these waxes will not melt. Solubility of the waxes is said to be unaltered and they are recommended for use wherever waxes are specified for use at elevated temperatures.

GENERAL CONTROL CO., Boston 34, has designed a new synchronous motor timer for accurate control of a wide variety of timed operations. This type SY "Promatic" timer can be used for all time periods between ½ sec and 24 hr. It actuates five single pole double throw load contacts independent of the timer control circuits. There are two separate solenoids; one operates the clutch and timing mechanism, the other actuates the load contacts. The timer automatically resets for each new cycle.

A new telescopic, single leg derrick, for ½, ¾ and 1 ton trucks is available from *POWERS-AMERICAN DIV., McCABE-POWERS AUTO BODY CO.*, 5900 N. Broadway, St. Louis 15. This "Uni-Lift" is designed for use with multiple pulley blocks. For convenience in handling materials of different size, weight, and shape the derrick base is keyed to permit positioning of the boom at two angles of elevation. In addition, the upper section of the boom may be telescoped for greater capacity when maximum height is not required. The derrick is raised semi-automatically by means of an elevating spring, and when not in use, the boom is stowed in a telescoped position along the body side panel.

"Eutect-Mask", a new aid in protecting surfaces from being marked by flame, spatter, arc, and similar "casualties" has been developed by *EUTECTIC WELDING ALLOYS CORP.*, 40 Worth St., New York 13. Canned in thin paste form, the new compound can be spread with the welding flux over the area to be protected. The dried residue, it is claimed, is easily removed after the welding operation is completed.

A four-hour fire rating has been given by the Underwriters Laboratories to Fenestra building panel steel floor construction manufactured by *DETROIT STEEL PRODUCTS CO.*, 3381 Griffin St., Detroit 11. This construction is protected by a ⅞ in. thick plastered ceiling using perlite aggregate on metal lath. Above the ceiling, sheet metal air ducts were suspended from the steel floor, in the test, and opened through the ceiling at 20 in. air diffusers protected with automatic fire dampers.

The model M-OM snap action switch of *ACRO SWITCH DIV., ACRO MFG. CO.*, Columbus 16, Ohio, is particularly recommended for condensed timing and sequence operation. It is an open blade switch utilizing the company's rolling spring principle. Current carrying capacity is 3 amp at 125 volts, a-c.

WHO'S WHAT

H. BLAKE THOMAS, vice president in charge of sales, *McQUAY INC.*, Minneapolis, has been elected to the board of directors. He has been associated with the company since 1930, serving as assistant, then general sales manager, before his appointment as vice president in 1948. At a recent annual meeting, all other members of the board were reelected..... *DECHARD A. HULCY*, president of the Lone Star Gas Co., Dallas, and president of the American Gas Association, is the new president of the *CHAMBER OF COMMERCE OF THE U.S.*

MELVIN A. JACKSON and *ROBERT W. WEAVER* are newly elected vice presidents of *GRANT WILSON, INC.*, Chicago. Both men have served in various sales and managerial positions, Mr. Jackson since 1938 (except for a leave-of-absence for Army Air Force service) and Mr. Weaver since 1945.

E. W. SMITH has been elected as a vice president of *OWENS-CORNING FIBERGLAS CORP.*, Toledo, O., by its board of directors. Mr. Smith is in charge of merchandising and advertising programs, and other activities in the general sales department. Prior to joining the company (in 1949), he was vice president for sales of Philip Carey Mfg. Co. Previously he served in various sales capacities with Johns-Manville Corp. and Certain-teed Products Corp.

ALBERT B. DISS is now manager of manufacturing operations for *WATSON-STILLMAN CO.*, Roselle, N.J. He will head all activities in the manufacturing, production, purchasing and sub-contracting departments. Formerly associated with National Lead Co. and then McKinsey & Co., New York, he joined the company in 1950 as assistant to the executive vice president.

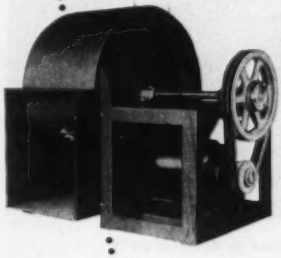
JAMES S. ANDERSON, assistant general sales manager of *THE BABCOCK & WILCOX TUBE CO.*, Beaver Falls, Pa., is now chief of the newly created *TUBING SECTION*, Iron and Steel Div., Industries Operations Bureau, *NATIONAL PRODUCTION AUTHORITY*. His headquarters will be Washington, D. C.

R. N. HILL, member of the board of directors, *CENTURY ELECTRIC CO.*, St. Louis, has been appointed vice president in charge of operations. He has served the company since 1920. *JOYCE PILLSBURY*, a member of the board of directors and assistant secretary, has been appointed secretary. The son of *E. S. PILLSBURY*, chairman of the board, he has been with the company since 1931. *WILLIAM HELM* is district sales manager heading the company's new district sales office, 2400 W. Clybourn St., Milwaukee 3.

ROBERT D. MOSSMAN, manager of advertising, *JONES & LAUGHLIN STEEL CORP.*, Pittsburgh, will serve as volunteer coordinator of an emergency steel scrap salvage advertising campaign sponsored by the *ADVERTISING COUNCIL, INC.*, a non-profit business organization, and requested by both the American Iron and Steel Institute and the National Production Authority.

HERE'S YOUR COMPLETE COMPACT, VENTILATING BLOWER

Peerless Electric



BELT-DRIVE UTILITY BLOWERS

Peerless Belt-Drive Utility Blowers are designed to deliver large volumes of air at extremely economical cost. These blowers are widely used for general ventilation and exhaust where duct systems are required. The units are compact, easy to mount and quiet in operation.

HOUSING AND WHEELS

The arc-welded housings are constructed of 16-gauge steel, with sturdy spot-welded motor bases. Wheels are dynamically balanced.

MOTORS

Peerless manufactured. Available in all types of current characteristics.

ROTATION AND DISCHARGE

Furnished either for clock-wise or counter-clockwise rotation and to discharge in any direction.

CUSTOM FEATURES

Weatherproof covers, available for outside installation, eliminate the need for penthouse or other protection. Inquiries are invited for other special features that may be desired.

CAPACITIES

Tested in accordance with standard test codes.

Write for complete specifications

THE PEERLESS ELECTRIC COMPANY

Established 1893 • WARREN, OHIO

Peerless Electric

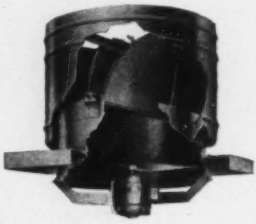
MOTORS • FANS • BLOWERS

Lockheed uses 6 Sky-Blasts for air movement at Burbank plant

Lockheed believes in advanced design in ventilation as well as in planes. Six new Propellair SKY-BLASTS were recently installed on Building 93 at Lockheed Aircraft Plant, Burbank, California. These units each move 28,800 cubic feet of air per minute, regardless of wind conditions.

BUILT TO DO A REAL JOB

Sky-Blast design is strictly functional. No frills. No gadgets. A powerful suction sweeps up heat, moisture, dust, fumes—a strong exhaust shoots them high into the outside air. Engineering refinements include automatic butterfly dampers that will not leak, streamlined wind guard, and non-clogging rainshed. Heart of the Sky-Blast is the famous cast-aluminum airfoil propeller—powered by a fully-enclosed, weather



resistant Robbins & Myers motor. Sky-Blast air deliveries range from 2800 CFM to 78,800 CFM.

SIMPLEST INSTALLATION

Easily mounted on any type roof, where they are never in the way, Sky-Blasts clear the air and improve working conditions. New Bulletin H-680-P gives complete information. Write for it today.

PROPELLAIR

SKY-BLAST

POWER ROOF VENTILATOR

PROPELLAIR DIV., ROBBINS & MYERS, INC., SPRINGFIELD, OHIO

Three new sales executives have been appointed by *AMERICAN RADIATOR & STANDARD SANITARY CORP.*, Pittsburgh. *JOSEPH SALAMONE*, with the company since 1923, has been named general manager of sales, and *DANIEL J. QUINN*, who has served since 1925, has been promoted to sales manager, plumbing and radiator heating div. Both were most recently assistant general managers of sales. *H. M. CARNAHAN*, who has been manager of the Pittsburgh sales office, is now sales manager, warm air heating div.

In addition, *ROSCOE SPRINGSTON*, a gas and oil heating controls specialist formerly with the company's subsidiary, Detroit Lubricator Co., has been appointed to the staff of the application selling department where he will handle technical field problems and assist in training heating wholesalers and contractors.

The new officers elected at a recent meeting of the *SHEET METAL CONTRACTORS NATIONAL ASS'N.* are: *E. B. BROWN, JR.*, Chicago, president; *ANGELO HOFFMAN*, Milwaukee, first vice president; *A. J. SABATHNE*, Altoona, Pa., second vice president; *A. J. de l'ETOILE*, Cambridge, Mass., third vice president; *C. M. GUNDLACH*, Sandusky, O., treasurer; and *J. D. WILDER*, Elgin, Ill., executive secretary.

GERALD D. DODD, assistant to the president, *FOSTER WHEELER CORP.*, New York, will assume charge of manufacturing at the company's Carteret, N.J. and Dansville, N.Y. plants. He succeeds *WILLIAM LONSDALE*, vice president in charge of manufacturing, who has passed the active duty retirement age, but will be retained as a special consultant prior to his full retirement.

JACK J. TIPTON, formerly project engineer (primarily concerned with combustion control), *HAYS CORP.*, Michigan City, Ind., has been appointed chief project engineer. He will oversee the acceptance and handling of orders for all the company's products.

NORMAN A. STRANG has been appointed advertising manager of *SKF INDUSTRIES, INC.*, Philadelphia, succeeding *ROBERT C. BYLER* who died recently. Since 1940 (with the exception of three years in Coast Guard service) he has served the company in sales, sales promotion and writing positions, and as assistant advertising manager (1950).

W. A. SIEGFRIED, president, *SUPERIOR VALVE & FITTINGS CO.*, Pittsburgh, was elected president of the *REFRIGERATION EQUIPMENT MANUFACTURERS ASSOCIATION* at its recent annual board of directors meeting. He succeeds *R. H. ISRAEL*, sales manager, Refrigeration Department, *VIRGINIA SMELTING CO.*, West Norfolk, Va. *R. L. SEARS*, director of sales, *LYNCH CORP.*, Toledo, O., was elected vice president. Also elected were *JOHN E. DUBE*, president, *ALCO VALVE CO.*, St. Louis, as treasurer; and *L. C. McKESSON*, vice president in charge of sales, *ANSUL CHEMICAL CO.*, Marinette, Wis., as secretary.

Three new engineers recently have joined the staff of *H. E. BOVAY, JR.*, Consulting Engrs., Houston, Tex. They

are *AARON J. COHEN*, mechanical and production engineer, who has worked for such companies as The Port of Houston Iron Works, The Houston Lighting and Power Co., and Todd Shipbuilding Corp. (where he received three Awards of Merit from the Maritime Commission); *DAVID M. BENTLEY*, specialist in management engineering, most recently with J. G. White Engineering Co., New York; and *BERNARD R. BOGAN*, consulting civil engineer, who has worked for Kaiser Shipbuilding Corp., Richmond, Calif., and for the State of Texas.

COMBUSTION CONTROL CORP., Cambridge, Mass., has appointed *LAURENCE D. SIBLEY* as vice president in charge of sales. He has been with the company in executive capacities since 1945, and has been general sales manager since 1949.

EDWARD BARWELL, since 1926 associated with Crocker-Wheeler Electric Mfg. Co., has been named industrial relations coordinator of *WORTHINGTON PUMP AND MACHINERY CORP.*, Harrison, N.J., to assist the vice president in charge of manufacturing. Mr. Barwell served on the Industry Tri-Partite Panel of the National War Labor Board from 1942 to 1945.

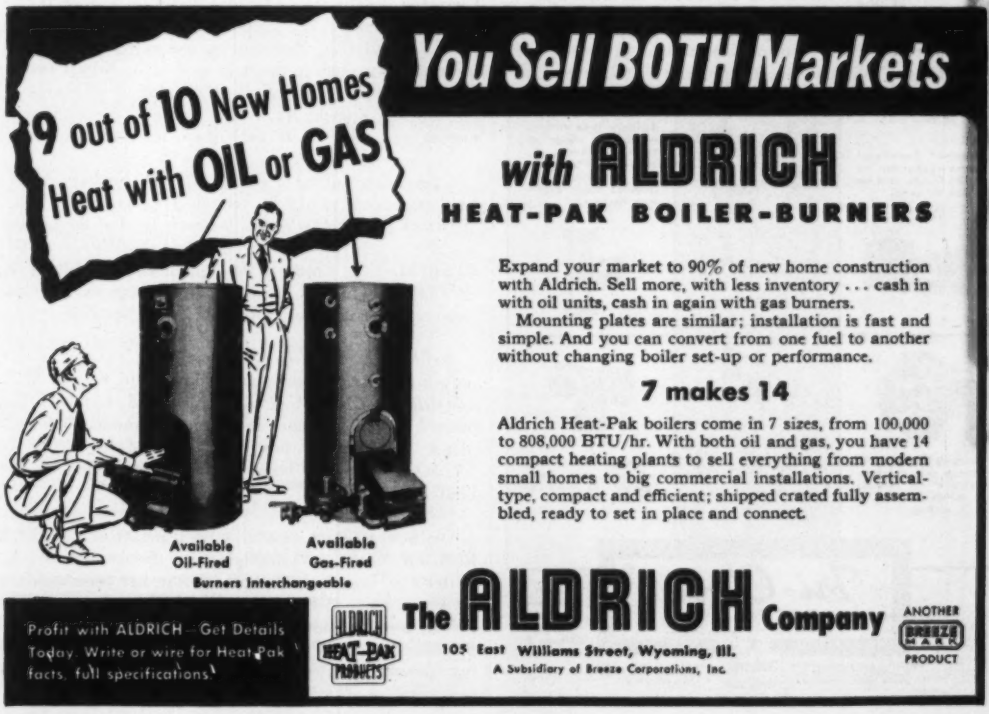
ROY A. HUNT, president since 1928 of *ALUMINUM CO. OF AMERICA*, was named chairman of the executive committee at a recent board meeting. *I. W. WILSON*, senior vice president since 1949, succeeds him as president, and *LEON E. HICKMAN*, senior partner of the Pittsburgh law firm, Smith, Buchanan & Ingersoll, was elected vice president and general counsel.

Two new vice presidents have been named for the *REFRIGERATION DIV., PHILCO CORP.*, Philadelphia. *JAMES M. SKINNER, JR.*, who joined the company in 1934 and most recently has been general sales manager of this division, will be in charge of sales. *RAY A. RICH*, who joined the company in 1949 as product manager, electric ranges, will be in charge of products.

Promotions at the Lima, Ohio *SMALL MOTOR DIV., WESTINGHOUSE ELECTRIC CORP.*, include *H. E. GROUT*, who has served the company for 26 years, now named works manager (in charge of all manufacturing activities for the division); *W. P. BELL*, who was most recently superintendent of quality control, now named manager of manufacturing (in charge of all line manufacturing activities); and *C. F. HERBOLD*, who has served in various capacities with the Lima and Cleveland works, now appointed superintendent of quality control.

EDWIN B. McCONVILLE, a vice president of *SKILSAW, INC.*, Chicago, since 1949, has been elected executive vice president. *PAUL WATTS*, most recently general sales manager, was elected vice president in charge of sales, and *RALPH B. BRUNDRETT*, formerly comptroller, is the new company treasurer.

HAROLD L. ZIMMER, formerly with the St. Louis Star Times, has been appointed advertising manager for *CURTIS MFG. CO.*, St. Louis..... The new vice president in charge of sales for *CHICAGO NIPPLE MFG. CO.* is *R. H. SONNEBORN*, who has been with the company for the past eight years, and was secretary and gen-


9 out of 10 New Homes
Heat with OIL or GAS
You Sell BOTH Markets
with ALDRICH
HEAT-PAK BOILER-BURNERS
Expand your market to 90% of new home construction with Aldrich. Sell more, with less inventory ... cash in with oil units, cash in again with gas burners.
Mounting plates are similar; installation is fast and simple. And you can convert from one fuel to another without changing boiler set-up or performance.
7 makes 14
Aldrich Heat-Pak boilers come in 7 sizes, from 100,000 to 808,000 BTU/hr. With both oil and gas, you have 14 compact heating plants to sell everything from modern small homes to big commercial installations. Vertical-type, compact and efficient; shipped crated fully assembled, ready to set in place and connect.
Available Oil-Fired
Available Gas-Fired
Burners Interchangeable
Profit with ALDRICH — Get Details Today. Write or wire for Heat-Pak facts, full specifications.
ALDRICH HEAT-PAK PRODUCTS
The ALDRICH Company
105 East Williams Street, Wyoming, Ill.
A Subsidiary of Breeze Corporations, Inc.
ANOTHER BREEZE MARK PRODUCT

TRI-CLOVER
...ION RESISTANT

Made to Perfection for Your Protection

FOR over 30 years Tri-Clover has supplied Industry with the finest and most complete line of stainless steel and alloy fittings, valves, pumps, tubing, pipe and specialties.

Benefit from this broad experience covering all types of liquid conveying line applications. Assure yourself of the highest performance by specifying *Tri-Clover*.

Industrial Centrifugal Pumps—Capacities up to 125 G.P.M. and up to 250 ft. head.
Butt welded fittings furnished in flanged assemblies. Ordinarily a "special" item, furnished as "standard" by Tri-Clover.
Sanitary Type Fittings — A full range of types, polished I. D. and/or O. D., from 1-in. thru 4-in. O. D. Includes many exclusive designs.
Stainless Steel Screwed Fittings and Valves—Precision cut threads to match standard I. P. S. piping.
"Zephyrweld" Welding Fittings—Fabricated in O. D. tube sizes ¾ thru 24 in.
Recessed-End Fittings — Low cost, lightweight, in sizes ¾ in. thru 24 in.

Tri-Clover®
MACHINE CO.
Kenosha, Wisconsin

Export Division—8 South Michigan, Chicago 3, U. S. A.

TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TUBING, SPECIALTIES

TRI-CLOVER
THE Complete LINE

FABRICATED STAINLESS STEEL INDUSTRIAL FITTINGS AND INDUSTRIAL PUMPS

eral manager of sales. *E. CONDIT*, former secretary, is now secretary and treasurer, and *A. PREIWISCH* is the new assistant secretary.

DUDLEY B. ROBINSON is the new general sales manager of *THE TORRINGTON MFG. CO.*, Torrington, Conn. He joined the company in 1949, as assistant general sales manager, and previously had been associated with the Warren McArthur Corp., Bantam, Conn.

M. H. PENDERGAST, who joined *LYNCH CORP.*, Toledo, O., in 1938, and became president of the company in 1949, recently tendered his resignation as president and as a director. *F. K. ZIMMERMAN*, formerly secretary-treasurer, has been elected to take over the presidency.

HENRY GEISSLER, power apparatus application engineer, has been appointed product manager, heavy duty fan equipment, by *WESTINGHOUSE ELECTRIC CORP., STURTEVANT DIV.*, Boston. *JOHN E. McDONALD* is the division's new assistant manager, air handling engineering.

ROBERT L. DAY is now a factory sales engineer for *GENERAL CONTROLS CO.*, and will be headquartered at the company's Glendale, Calif., plant. Most recently, he has been senior sales engineer in the San Francisco factory branch office. . . . . *CARL MACKPRANG*, formerly assistant purchasing agent, *PYLE-NATIONAL CO.*, Chicago, has been appointed purchasing agent.

CUTLER-HAMMER, INC., Milwaukee, has named *O. P. PROUDFOOT*, of the Buffalo sales staff, manager of the Cleveland district sales office to succeed *R. J. ECKSTEIN* who died recently. . . . . *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis, has assigned three new industrial managers to the field staff of its Brown Instruments Division. *JOSEPH H. MATULIS* is in charge of the Chicago branch, *WILLARD SMITH*, the Pittsburgh branch, and *JOSEPH H. BOWMAN*, the Buffalo office.

A new branch office of *FOXBORO CO.*, Foxboro, Mass., has been opened at 618 W. Church Ave., Knoxville, Tenn. *MARVIN L. CLEATON, JR.*, formerly head of the Columbus, Ohio, office, is in charge. . . . . *ILLINOIS ENGINEERING CO.*, Chicago, has appointed *HOFFMAN & HOFFMAN*, 115 N. Church St., Greensboro, N. C., company representative for North and South Carolina.

ROBERT D. SCOTT, JR., since 1942 manager of the polyvinyl chloride resin plant at Louisville, Ky., of *B. F. GOODRICH CHEMICAL CO.*, Cleveland, has been appointed general manager in charge of production for all plants. His former post will be filled by *JOHN L. NELSON*, who has been production manager of the Louisville plant.

The new assistant general sales manager of *QUAKER RUBBER CORP.*, Philadelphia, a division of H. K. Porter Co., Inc., is *J. R. LEWIS*, who has been with the division since 1940. . . . . *KENNETH P. HENGESBACH*, formerly power plant sales engineer in the Philadelphia office of *SWARTWOUT CO.*, Cleveland, is directing power plant equipment sales in the company's new office at 836 Michigan Theater Bldg., Detroit.

NEW BOOKS & REPORTS

Proposes Unusual Heat Source For Heat Pumps

It is generally agreed by all who have concerned themselves with the heat pump that the principal problem is providing a suitable heat source. This is especially true in northern localities where the maximum heating load is about twice the maximum cooling load. Utilizing background material obtained from extensive studies on the subject of district heating, or rather residential group heating, J. A. Eibling and B. A. Landry, of Battelle Memorial Institute, have prepared a paper, The Steam-Generating Station as a Source and Sink for the Heat Pump.

This paper reports on an investigation in connection with using waste heat in the condensing cooling water from steam-power generation as a source of heat. For cooling, a centrally located spray pond would serve as a heat sink. Purely for comparative purposes, a system is analyzed where an underground system of piping, called the loop, is utilized for circulating water between the power plant and heat pumps located in the area or community served. During the heating season, the loop water passes through the steam condensers of the turbo generators and serves the dual functions of condensing cooling water and of providing a heat source.

According to the authors, a system of this type would provide a heat source that can be controlled within close temperature limits and that is not affected by climate, location, or legal restrictions. It would also provide a suitable heat sink and a much higher overall annual coefficient of performance. Where the maximum heating load is greater than the maximum cooling load, a smaller size of heat pump could be used, as compared to a system utilizing a ground coil for the heat source. The annual load factor on the power system supplying the area would be improved. The authors recognize a number of limitations. Because of pumping costs, the size of the area which could be served economically by the system is far below that which can be supplied with power from a large modern power station. Decentralization of generating capacity is, therefore, a necessary feature of the system. To fulfill the heat source requirements of the heat pumps with heat in the condenser cooling water alone, the total load on the power plant must be at least 1.6 times the power consumed by the heat pumps.

Identified as Paper No. 51-S-16, the report was presented at the recent spring meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18.

Provides Basic Information on Building Operation and Maintenance

Building Operation and Maintenance, by C. A. March, is a compendium of facts which can be used by building owners, managers, and superintendents in dealing with problems arising in their everyday work. The author, who is assistant to the superintendent of building operation, The Detroit Edison Co., has drawn on a wide range of original sources (including books, reports, professional papers, etc.) to present this general survey.

The chapter on heating briefly outlines the various types

With This NEW Improvement Niagara "No-Frost Method" puts you a big step ahead in trouble-free, automatic refrigeration or freezing

Niagara "No-Frost Method" keeps frost and ice COMPLETELY OUT of your cooling, chilling, freezing or cold storage.

It uses Niagara No-Frost Liquid Spray to keep frost and ice from ever forming. It gives you, automatically, refrigeration with no defrosting, and full capacity NEVER cut down by ice building up progressively on refrigeration coils.

Now, a NEW design No-Frost Liquid concentrator, using a new principle, takes away moisture as fast as it is condensed by evaporating it at low temperature —not boiling it away at high temperature. It has 14 times the capacity of the old method per dollar of investment — one concentrator will handle a battery of high capacity spray coolers.

This gives you more refrigeration at lower cost; less machinery in less space. You operate at high suction pressure, saving power and wear and tear on compressors.

The extra capacity and lower cost both for equipment and operating makes this method advantageous for every type of refrigeration use—both for freezing and for moderate temperatures—for large "live" loads as in meat chilling or in fruit and vegetable precooling — for rooms that are filled and emptied of product daily, such as milk rooms and terminal storage warehouses.

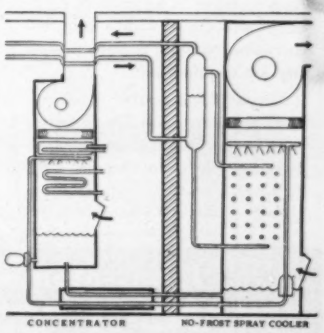
You get true trouble-free refrigeration . . . No brine . . . no salt solution . . . no dirt . . . no mess . . . It is entirely clean; you get rid of dirt and odors. You reduce both equipment and operating costs.

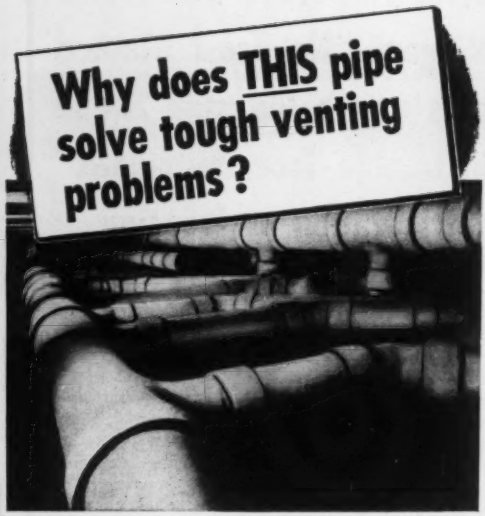
For complete information write to the Niagara Blower Company, Dept. HP 405 Lexington Avenue, New York 17, New York.

If you need extra capacity . . . the Niagara "No-Frost Method" can help you get it with your present compressor.

•

A simple method, easily maintained. Saves a third of your refrigeration cost . . . Ask for Niagara Bulletins 118 and 119.





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You will find further details on Transite Industrial Vent Pipe in Data Sheet Series DS-336. For your copy write Johns-Manville, Box 290, New York 16, N. Y. In Canada, 199 Bay Street, Toronto, Ontario.

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of systems, giving advantages and disadvantages of each. Different types of boilers, furnaces, and oil burners are covered in a non-technical manner, and emphasis of the chapter is, quite naturally, on the control of heating, the reduction of fuel costs, and the maintenance of heating systems.

Similarly, the chapter on ventilation and air conditioning provides a basic introduction to the subject, and covers various types of systems. Emphasis is on maintenance and factors affecting the cost of installing and operating. The chapter on piping briefly describes water cooling, water heating, hot and cold water distribution systems, corrosion problems and piping materials.

This 384 page, clothbound text is published by McGraw-Hill Book Co., 330 W. 42nd St., New York 18, and the price is $6.00.

Process Industries Must Control Air Pollution

The trend of public sentiment is that process industries must take steps to stop their contributions to air pollution. If this is not done voluntarily, legislation will force compliance with regulations or close up offending process plants. This statement was made by A. G. Christie, of Johns Hopkins University, when presenting his paper, Air Pollution—A Problem of the Process Industries, at the recent Process Industries Conference of the American Society of Mechanical Engineers.

Different elements may contribute to air pollution in different localities. In general, air pollution of an objectionable character is usually associated with certain meteorological conditions such as lack of winds, temperature inversion, persistent fog and the presence in a comparatively stagnant atmosphere of smokes, dusts, and gases. These factors are briefly described by the author, who also covers the use of cyclone separators and electrostatic cleaners. Other practices mentioned by him which aid in the reduction of air pollution include the conversion of hand fired boilers to automatically fired plants, the use of higher chimneys to obtain adequate dispersion of gases after they leave the chimney, the use of low volatile coal, and the use of modern boilers in place of old and inefficient boilers. In discussing the washing of flue gases to remove smoke, fly ash and objectionable gases, Prof. Christie points out that this has been tried in a number of cases and has given rise to other problems in connection with the handling and disposal of the wash water which becomes acid and corrosive.

In his opinion, it pays to get the best dust collecting equipment available. Because there is a decided tendency throughout the country to pass ordinances with lower permissible dust contents in flue gases than were formerly allowed, dust collectors which satisfy present requirements may fail to be adequate under later regulations.

While process dusts can, in many instances, be recovered by available equipment and such dusts may have economic value, there are many instances where there is no known method by which discharges may be recovered at a reasonable cost or which would yield a return on the operation. In other cases, no economic use can be made of the recovered products, and their ultimate disposal adds further problems. In his opinion, it is in the interest of all process industries to publicize their experiences so that more factual data may be available.

Copies of the paper may be obtained from ASME headquarters, 29 W. 39th St., New York 18.

American Standard Covers Installation of Gas Piping

American Standard Installation of Gas Piping and Gas Appliances in Buildings, Z21.30-1950, sponsored by the American Gas Association and approved by the National Fire Protection Association, as well as the American Standards Association, provides a nationally applicable installation standard for safe and satisfactory use of gas piping and gas fired equipment. Standardization attempts have been made since 1912 by the gas industry and the NFPA, each of which has now withdrawn its former individually sponsored standard in favor of the new one.

The new standard, general enough to permit continuation of local ordinances, applies to low pressure (not exceeding 1/2 psi) piping systems in buildings, and covers the design, fabrication, installation, testing and operation of such systems for natural, manufactured, and liquefied petroleum-air gases or their mixtures. It does not apply to systems distributing undiluted, liquefied petroleum gas or to systems supplying equipment for specific manufacturing, production or power generating purposes.

There are separate sections covering piping installation, installation requirements for appliances in general and for specific appliances, venting procedures, and instructions for placing equipment in operation.

Copies may be obtained from ASA headquarters, 70 E. 45th St., New York 17, or from the AGA Laboratories, 1032 E. 62nd St., Cleveland 3, for 25 cents.

Condenses General Data on Air Moving Equipment

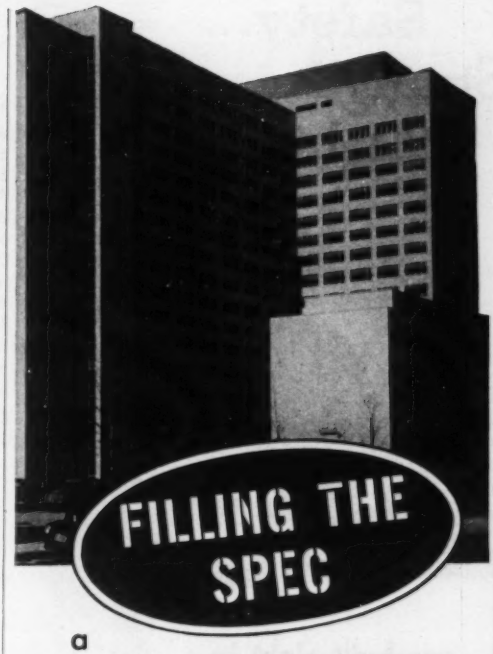
The second 1951 edition of How To Have Comfort From Moving Air, published by Torrington Mfg. Co., Torrington, Conn., is now off the press. Some 113 manufacturers, makers of 23 different types of air moving equipment, have cooperated with the company in preparation of this 180 page book.

Each of the 23 broad classifications of equipment is covered in separate sections which open with short articles explaining the use, installations, and results to be achieved from the particular type of equipment. In addition, the products of manufacturers are briefly cataloged. Equipment covered includes propeller fans, small dehumidifiers, air deodorizers, propeller type ventilators and exhaust fans, evaporative air coolers, room air conditioners, small centrifugal blowers, window ventilators, forced warm air central heating systems, unit heaters, etc.

Copies may be obtained from the company for 50 cents.

Other Books and Reports Received

PROTECTION OF CLOSED VESSELS AGAINST INTERNAL EXPLOSIONS, by E. W. Cousins and P. E. Cotton, of Factory Mutual Laboratories—If the maximum pressure is permitted to develop, it is not economical to build tanks and similar vessels to withstand, without damage, an internal explosion. Maximum pressure can be reduced by using rupture disks to relieve the explosion. Data supported by tests are presented to permit the design of disks for various sizes and strengths of vessels and for various gases and vapors. This paper (51-PRI-2) was



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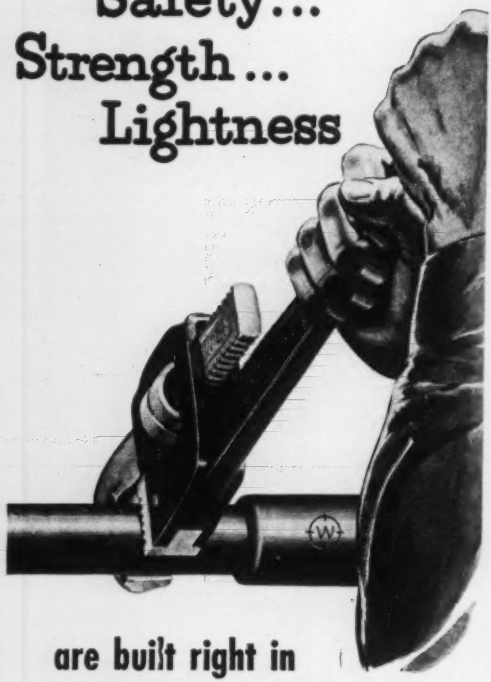

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presented at the recent Process Industries Conference of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18.

DIMENSIONAL ANALYSIS AND THEORY OF MODELS, by Henry L. Langhaar, professor of theoretical and applied mechanics, University of Illinois—Priced at $4.00, this 166 page, clothbound text is published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. It contains an algebraic development of the theory of dimensional analysis that reduces the theory to a branch of algebra and connects it closely with the theory of lineal algebraic equations. Systematic use of arithmetic matrices affords a routine numerical procedure for performing the dimensional analysis of any physical problem for which the variables are known. This use of matrices is said to eliminate cut-and-try methods and arbitrariness in results. Separate chapters deal with dimensional analysis in stress analysis, fluid mechanics, thermal problems, and electrical problems.

DEFENSE PRODUCTION RECORD—The first issue of a bulletin covering the defense production program and published weekly by the Office of Public Information, National Production Authority, is off the press. The purpose of the record is to provide a ready reference to the official actions of the defense production agencies in convenient form. The Vol. 1, No. 1 issue features an article on how CMP works for "A" products. Business firms, business service organizations, individuals, etc. may obtain copies from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at an annual subcription rate of $2.50. Single copies are available at 5 cents each.

PROTECTIVE COATINGS ON METALS—New literature and a patent survey covering protective coatings on metals recently have been made available from the Office of Technical Services of the U. S. Department of Commerce, Washington 25, D. C. The survey, prepared by the Quartermaster's Philadelphia Research and Development Library, emphasizes developments in this field since 1940. Entries include summaries or abstracts, as well as author, inventor and patent indexes. PB 102-172, Protective Coatings on Metals, contains 60 pages, and the 177 entries are arranged in three parts — light-metal coatings, heavy-metal coatings and organic coatings. The price is $1.50.

FUNDAMENTALS OF PATTERN DRAFTING AND BLUEPRINT READING—The original book, published before the war, has been revised and brought up to date. Written expressly for sheet metal men and offered by Armco Steel Corp., Middletown, Ohio, for 25 cents, the 61 page revised text gives basic facts necessary for an understanding of pattern drafting and blueprint reading. It is simply written and illustrated with sketches. The section on drafting starts with explanations of making patterns for elbows, tees, and piped intersections, and then gradually progresses to more complicated forms. The section on blueprint reading first discusses the use of lines, terms and symbols and then describes the relations of views in an engineering drawing. This is followed by chapters on dimensions, projections, and methods of determining sheeting requirements.

MEETINGS & CONVENTIONS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 29 W. 39th St., New York 18—The semi-annual meeting will be held, June 11 to 14, at the Royal York hotel, Toronto, Canada. More than 80 papers will be presented in 38 technical sessions. Some of the papers scheduled include:

Piping Flexibility Analysis, by Model Tests, by Lale C. Andrews, M. W. Kellogg Co.

Stress Conditions in Flanged Joints for Low Pressure Service, by Frank S. G. Williams, Taylor Forge & Pipe Works, and Everett O. Waters, Yale University

Some Aspects of the Design and Economic Problems Involved in the Safe Disposal of Inflammable Vapors from Safety Relief Valves, by S. Chesler and B. W. Jesser, M. W. Kellogg Co.

Methods of Reducing Dust Emission from a Spreader-Stoker Fired Boiler Furnace, by W. C. Holton and Richard B. Engdahl, Battelle Memorial Institute

Modern Methods and Equipment for Control of Steam Generators, by P. S. Dickey, Bailey Meter Co.

Electronic Combustion Control, by Charles H. Smoot, Republic Flow Meters Co.

A New Method of Determining Thermal Diffusivity of Solids at Various Temperatures, by D. Rosenthal and A. Ambrosio, University of California.

Dynamic Force Reactions in Double Ported Control Valves, by C. F. King and G. F. Brockett, Fisher Governor Co.

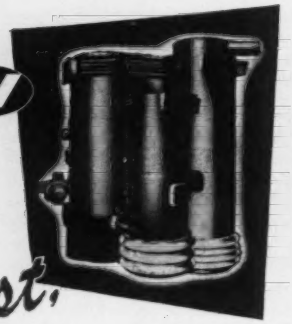
IBR HEATING SHORT COURSE—The fifth short course on hot water and steam heating, of the Institute of Boiler and Radiator manufacturers, will be held at Navy Pier, Chicago, June 12 to 15. There will be only one course given this year and it will be for advanced students. Additional information may be obtained from R. K. Newton, supervisor, engineering extension, Division of University Extension, Room 205, Arcade Bldg., University of Illinois, Urbana.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia—This year's annual meeting is scheduled for June 18 to 22 at Chalfonte-Haddon Hall, Atlantic City.

An important feature of the program will be the Edgar Marburg Lecture to be given by Frank L. LaQue, in charge of the corrosion engineering section, International Nickel Co. He will discuss corrosion testing. Some of the many technical papers to be presented will deal with coal sampling problems and both ferrous and nonferrous metals. There will be seven technical symposiums, including one on acoustical materials.

IBR SCHOOL OF MODERN HEATING—The school of modern heating, sponsored by the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, celebrated its first anniversary last April. A total of more than 2500 students have attended the school, which is being continued through 1951. This is a travelling school designed to provide an intensive three-day training in heating design and installation. Classes will be held this month in Detroit, Syracuse, and Buffalo. Classes are scheduled for next month in Albany and Elmira, N. Y.

STOKER MANUFACTURERS ASSOCIATION, 307 N. Michigan Ave., Chicago 1—The annual meeting will be



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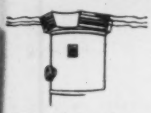

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held at the South Shore Inn, Lake Wawasee, Syracuse, Indiana, on June 25 and 26.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 51 Madison Ave., New York 10 — Semi-annual meeting, Portland, Ore., July 2 to 4. For details see the ASHVE JOURNAL SECTION in this issue.

EIGHTH INTERNATIONAL CONGRESS OF REFRIGERATION—to be held in London, England, August 29 to September 11. Additional information may be obtained from the secretary of the conference, Dalmeny House, Monument St., London, E. C. 3.

6th NATIONAL INSTRUMENT CONFERENCE AND EXHIBIT—Sponsored by the Instrument Society of America, 921 Ridge Ave., Pittsburgh 12. The affair will be held in the Sam Houston Coliseum, Houston, Tex., September 10 to 14.

INTERNATIONAL DISCUSSION OF HEAT TRANSFER—Postwar heat transfer developments will be the theme of a meeting, September 11 to 13, London, England. Plans for participation by engineers in the western hemisphere are being arranged by a joint committee on North American participation, which consists of representatives from some 12 professional and engineering societies. The American Society of Mechanical Engineers is coordinating administrative details.

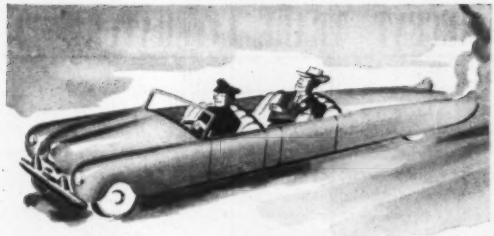
BRITISH BUILDING RESEARCH CONGRESS—Sponsored by a number of professional institutions and societies, government departments, and representative industrial federations, the congress will be held in London, September 11 to 20. Additional information may be obtained from the organizing secretary, Building Research Congress 1951, Building Research Station, Bucknalls Lane, Garston, Watford, Herts, England.

Among the papers to be presented during the heating and ventilating sessions is one on heat transfer, by Prof. C. O. Mackey, Cornell University, and one on radiant heating by Prof. F. W. Hutchinson, University of California.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York City—The 33rd annual convention, St. Louis, October 15 to 17. The Jefferson hotel will be headquarters for the residential gas and industrial and commercial gas sections; the Mayfair and Lennox hotels for the operating section; and the Statler hotel will house the accounting section.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 919 Milam Bldg., Houston 2, Tex.—The annual meeting of the South Central Region of the association is scheduled for October 18 to 20, at Corpus Christi, Tex.

NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION, 145 Public Square, Cleveland 14—The 1951 annual convention is scheduled for December 5 and 6, and will be held at the Hotel Cleveland, Cleveland.



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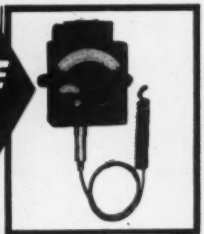

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Case 5½ x 5½ x 1¾"; Wt. 3 lbs. Standard ranges 50°—350°F and 50°—600°F, special ranges may be had between —120°F and +600°F. Standard differentials ½°F in circulating liquid, 2°F in air. Switch ratings 10 amp 125 V AC and 5 amp 250 V AC. Write for new bulletin No. 4816T which gives full details.

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Air Conditioning Equipment

HPAC 101—Air conditioning equipment, selected from the company's complete line, is described in a new 16 page condensed catalog (SA-6692) prepared by Westinghouse Electric Corp., Sturtevant Div., 200 Readville St., Hyde Park, Boston 36. Covered in the catalog are hermetically sealed compressors, condensers, water coolers, heating coils, cooling coils, air-handling units, heating and ventilating units, surface dehumidifiers, air washers, filter washers, central plant type completely self-contained conditioners, within-the-space type self-contained conditioners, unit heaters, industrial heaters, centrifugal fans, axial flow fans, ventilating sets, industrial fans, centrifugal compressors, induced and forced draft fans, and inlet vane control assemblies.

Air Conditioning Equipment, Defense Applications

HPAC 102—A new 28 page booklet directed "to United States Government Agencies and their suppliers," has been prepared by the Air Conditioning Department, General Electric Co., 5 Lawrence St., Bloomfield, N.J. In addition to covering some of the company's regular conditioners, heaters, refrigeration equipment, etc., for industrial and commercial use, the publication contains a section on products already being manufactured for the Government (transportable air conditioners, Quartermaster Corps water coolers, etc.). Marine refrigeration equipment manufactured by the company during World War II also is described.

Air Test Instruments

HPAC 103—Micromanometers, pitot tubes, Borozin smoke machines, dust counters, smoke sticks, smoke bombs, Kata thermometers, and various types of psychrometers (one of which is the new model motorized psychrometer with a 12 in. thermometer) are covered in a new six page bulletin released by E. Vernon Hill & Co., 6829 W. Highland Ave., Chicago 31. The new bulletin (No. 500) briefly covers design and construction features and includes prices.

Commercial-Boiler Burner Unit

HPAC 104—The No. 2000 boiler-burner unit of H. B. Smith Co., Inc., Westfield, Mass., is recommended for numerous small commercial applications. Available in four sizes (net IBR ratings of 1210 to 2210 sq ft of hot water radiation) the cast iron boiler may be used for either steam or hot water systems. It is available with a flush jacket or with the jacket extended to conceal the oil burner. Detailed information is given in a new four page illustrated bulletin.

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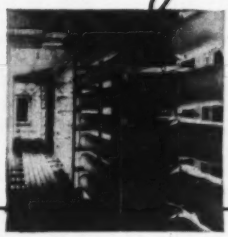

Leading textile plants are erecting ultra-modern buildings which are both *designed* and *engineered* for tomorrow. The structures represent the very latest trends in functional design . . . and the steam distribution systems must be engineered to perform with maximum efficiency. As you would expect, Badger Corrugated Packless Expansion Joints, constructed to the famous Directed-Flexing Self-Equalizing design, are first choice with these forward-looking companies.

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- Packless . . . pressure-tight single tube — requires no maintenance.
- Compact . . . approximately the size of flanged fitting.
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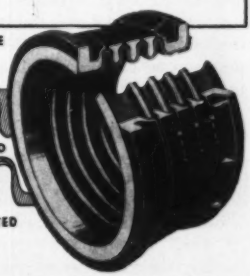

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Higher INVESTMENT RETURN

You can collect dust more efficiently, per dollar invested, with a Dustube. Its simplicity of design is reflected in its low cost to you. In the words of one user " . . . our Dustubes are the best investment we have ever made."

Lower OPERATING COSTS

Dustube users are fluent in their praise of its power savings. For example two users report: "The dustube is certainly the least expensive of all dry type collectors to operate and maintain." "Power costs are exceptionally low due to the ample spacing of the tubes which decreases resistance to air flow."

Lower MAINTENANCE COSTS

The low cost of maintenance with a Dustube is shown in the following quotations from three typical users: "Its simplicity of design appeals to our maintenance gang, since thorough inspection is so easy and rapid." "Shaking periods to clean the cloth tubes are short and infrequent—there is no delay in our busy cleaning schedule due to down time of the collectors." " . . We save both hours and dollars in maintenance costs."

GET THE FACTS ON DUSTUBES. WRITE FOR LITERATURE.

ADVANTAGES

BETTER DUST REMOVAL—Simple, fast, thorough. Shortens cleaning time.

POWER SAVINGS—Lower resistance to air flow. Lower air velocities.

HIGH EFFICIENCY—Nearly 100% efficient by convincing tests.

EASE OF INSPECTION—Clean, safe, simple. No parts to remove.

LESS FILTER WEAR—No abrading metal contact. Easy to ship, store and handle.

FASTER FILTER REPLACEMENT—Takes only a few seconds. Requires no tools.

American

WHEELABRATOR & EQUIPMENT CORP.

619 S. Byrkit St., Mishawaka, Ind.

dustube COLLECTORS

Low Cost
Fast Work
Leakproof
Permanent

IT'S THIS EXCLUSIVE
RECESSED
BRASS SEAT
that means
JOINTS THAT
STAY TIGHT!

. . . when you use
JEFFERSON
SPECIALTY UNIONS

*Made from malleable iron with tensile strength of 55,000 lbs. per sq. in.—they won't fail.

*Rings are cut from a special brass tubing—they're *not* cast.

*Ring channels are *machined* rather than cast—no rocking of the seat.

*All Jefferson Unions are air tested for leakage before shipment.

These are just a few of the reasons why you should investigate our unions for your piping assemblies. We're sure you'll find them to be the solution to your piping problems.

JEFFERSON UNION CO.
607 West 26th Street, New York 1, N. Y.
35 Fletcher Avenue, Lexington 73, Mass.
65 Gooding Street, Lockport, N. Y.

Send for Nicholson
TRAP CATALOG 250

A Standard Reference on Traps for All Applications

Newly revised, this 32-page reference describes traps for all mediums and pressures: thermostatic and metal expansion for pressures to 225 lbs.; weight and piston-operated for heavy duty. Complete with installation

diagrams and formulae for determining proper size trap.

W. H. NICHOLSON & CO. 198 OREGON STREET WILKES-BARRE, PA.
Sales and Engineering Offices in 53 Principal Cities

Compressed Air Filters

HPAC 105—The "Liqui-jector" is a filter unit designed for continuous and automatic cleaning of large volumes and high pressures of compressed air and other gases contaminated with water, free oil, water-oil emulsions and dirt. It is described and illustrated in Bulletin SC-10.11 which contains principal specifications and dimensions. The manufacturer is Selas Corp. of America, Philadelphia 34.

Controls for Water Pumping Systems

HPAC 106—Multi-pump "Mototrols," pressure operated pump controls, are available from Automatic Control Co., St. Paul 4, Minn., and are designed to automatically operate two or more pumps by means of pressure changes at predetermined high or low tank levels. Bulletin No. 1210 gives detailed information on design and construction features. Bulletin No. 1510 deals with the company's "Duotrols," combination pump and air controls designed to maintain pressure exactly and to coordinate the control of two or more pumps in pressure tank systems.

Corrosion Resistant Fittings

HPAC 107—A new eight page booklet, issued by Horace T. Potts Co., Erie Ave. and D St., Philadelphia 34, covers corrosion resistant fittings. In addition to describing the new fittings, the booklet describes the use of light-walled Schedule 5S corrosion resistant piping to reduce the cost of a typical piping layout.

Dry Expansion Type Coolers

HPAC 108—Patterson-Kelley Co. Inc., 304 Burson St., East Stroudsburg, Pa., has issued a 12 page illustrated catalog on "Freon" or ammonia coolers of the dry expansion type. These units are designed for use with water and other fluids for air conditioning, refrigeration, industrial and process cooling applications. In addition to describing the coolers, the catalog contains charts and tables showing the surface required for capacities from 2 to 232 tons of refrigeration at water flow rates from 15 to 575 gpm and for various baffle spacings in single and two-circuit designs. A log mean temperature table, cooler selection data, dimensions, pressure drops, and typical piping arrangements are also included.

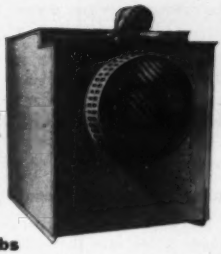
Dust and Fume Control

HPAC 109—The first issue of its new house organ devoted to developments in industrial dust and fume control is available from American Wheelabrator & Equipment Corp., 555 S. Byrkit St., Mishawaka, Ind. This issue contains illustrated case histories on the application of the company's "Dustube" cloth-tube filters to dust control problems in various industries. Information is given on the collecting efficiencies of these filters.

Expansion Joints

HPAC 110—Sizes, dimensions, suggested applications, and other technical data on a variety of expansion joints and flexible connectors are given in Bulletin 351, recently issued by Zallea Bros., Taylor & Locust Sts., Wilmington 99, Del. The joints covered range in size from small flexible connectors for use on diesel exhaust lines through 30 ft diameter self-equalizing joints for use in such applications as wind tunnels, etc.

the Adaptable AQUATOWER



shipped completely assembled; shipped knocked down

for the 3 to 60 ton jobs

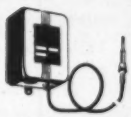
- **AVAILABLE** now for over-the-counter delivery! See your nearest Marley representative (one in every large city), or write for Bulletin AQ-51.
- **ACCEPTED** as the standard cooling tower of the refrigeration and air conditioning industries!
- **ADAPTABLE,** indoors or out, to fit your space and your cooling requirements!

MARLEY **The Marley Company, Inc.**
KANSAS CITY 15, KANSAS

AUTOMATIC CONTROL *for product or process*

L-34 Fan and Limit Control

T-70 Room Thermostat



A-100 Thermopilot Relay Automatic Reset

BX-69 Room Thermostat Package Set

TX-5 Cold Air Return Package Set

GENERAL CONTROLS
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Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cincinnati 2, Cleveland 15, Dallas 2, Denver 4, Detroit 21, Glendale 1, Houston 6, Indianapolis 4, Kansas City 2, Minneapolis 2, Newark 6, New York 17, Philadelphia 23, Pittsburgh 22, St. Louis 3, San Francisco 7, Seattle 1, Tulsa 6, Washington 6.
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CEILING SHUTTER

FOR ATTIC FAN

Built so they can be installed practically flush with the ceiling, AIR-FLO Ceiling Shutters present a refined, finished appearance. Their natural aluminum color blends with any decoration, eliminating need for painting, and no grille or winter cover is required. Furnished in 5 different widths, single panel up to 72" long. No operating mechanism shown. Built-in fusible link. Meets fire underwriters requirements.

WRITE FOR NEW CATALOG 43-D

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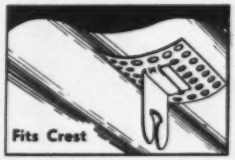
Stic-Klips with CURVED BASES for Insulation Installation on Corrugated Surfaces of Penthouses and Metal Buildings.



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Fits Trough

For all corrugations of Steel, Aluminum and Asbestos

Illustrated Pamphlets and Catalogs Mailed on Request

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For Accurate Measurement of Air Velocity and Air Pressure

Low Velocity Range: 0-750 fpm
High Velocity Range: 750-4000 fpm
Pressure Range: 0-4 inches water

Based on the hot thermopile principle, the AGITAIR Meter gives instantaneous accurate measurements of air velocities as low as 5 fpm, and as high as 4000 fpm. It is inherently stable, does not waver or jerk and unlike many resistance type hot-wire instruments it is free from errors caused by temperature variations, radiation effects and lead resistance. For taking static pressure readings from 0 to 4" wg, a special attachment is provided. The simplicity and utility of the AGITAIR Meter make it useful for many diverse applications.

Write for Bulletin AM-100

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17 East 42nd Street New York 17, N. Y.
Air Diffusers • Air Filters • Exhausters

...here are the reasons why

Grant Wilson
DUX-SULATION
ASBESTOS PROTECTED

Is **BEST FOR DUCT INSULATION**

1 High thermal and acoustical insulating properties... K factor of .27 BTU and sound absorption approximately 61%. Integral, woven asbestos membrane.

2 Easy to handle, easy to install correctly, can't be crushed or cracked, springs back to original thickness if compressed. Supplied with special glue and tape, no "fasteners" needed.

3 Constant insulating values. Can't "powder", shift or sift; no thin spots, even at corners. No deterioration of any kind, no change of any kind.

4 Perfect adhesion, flexible, conforms to uneven surfaces. Can be installed in the shop and still withstand all necessary handling. Specifically engineered for duct application ONLY!

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Grant Wilson inc.

IN NEW YORK CITY: Air Conditioning Utilities Co., 8 West 40th Street, New York 18, N. Y., LOngacre 3-4280.
IN CANADA: Atlas Asbestos Co., Ltd., Montreal, Toronto, Winnipeg, Vancouver.

Hermetic Refrigeration Compressors

HPAC 111—Detailed descriptions of the 2, 3, 5, and 7½ hp hermetically sealed refrigeration compressors and condensing units of Westinghouse Electric Corp., Sturtevant Div., 200 Readville St., Hyde Park, Boston 36, are given in Bulletin 101-110. Features of the types CLS-74, -110, -188, and -282 compressors and condensing units are covered and specification data are unusually complete.

Large Induction Motors

HPAC 112—The large, polyphase induction motor, and where it fits into the industrial picture, is the subject of a new 28-page booklet (B-4739) available from Westinghouse Electric Corp., Box 2099, Pittsburgh 30. The booklet presents a quick summary of the types and features of the two basic kinds of induction motors—Type CSF squirrel-cage motors for constant speed drive, and Type CWF wound rotor motors for adjustable speed drive. Applications are illustrated for a number of industries.

Liquid Chiller

HPAC 113—Bulletin 50-A (revised) of Acme Industries, Inc., Jackson, Mich., is a new two page, two-color specification sheet on its "Flow Cold" liquid chiller.

The sheet illustrates the single and dual compressor units and also shows the finned coils, convectors, and cooling towers which the company manufactures. Specifications, dimensions and weights are given, as well as additional ratings for all models.

Mitering Tool

HPAC 114—Metalmitre Inc., 9068 Culver Blvd., Culver City, Calif., has prepared an eight page leaflet describing its hand tool designed for mitering, notching, trimming and nibbling sheet metal. Sketches show applications of the various models: the standard type for flat surfaces (angles, flanges, etc.); the V-notch series which fits the lip of stainless steel no-drip channels; and the model for channel-type moldings, hard to reach channels and cap strip. All types are available for both 45 and 90 deg cutting. Slot- and notch-cutting models are also described.

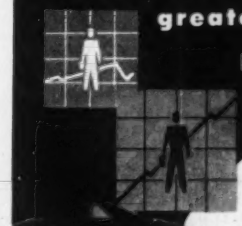
Piping Pointers

HPAC 115—A new edition of a manual on piping pointers is available from Crane Co., 836 S. Michigan Ave., Chicago 5. It covers the fundamentals of sound piping practices in easy-to-grasp, non-technical language. It discusses the various types of valve designs and how each should be used. It also illustrates and names more than 80 kinds of fittings. More than half of this 36 page manual is devoted to how-to-do-it features that are illustrated. Included with the manual is the company's selection guide for common piping services. Also available is a 30 min., 16 mm sound film on piping pointers, for use with the manual in training beginners and refreshing veterans in industrial piping crews.

Portable Dehumidifier

HPAC 116—The model R-18 "Desomatic" air dryer of Desomatic Products Div., Daly, Merritt & Sullivan, Inc., 1109 W. Broad St., Falls Church, Va., is briefly covered in a new pamphlet. Incorporating a hermetically sealed refrigeration compressor, the unit is plugged in to a convenient electric outlet and may be connected for

How to promote greater PER-MAN productivity!



Well-ventilated working environments contribute to faster, better defense production.

Western Rotary Turbine Ventilators provide constant, round-the-clock exhaust *without power*. A 2-mph breeze keeps your Western Rotary System in operation. Lifetime guaranteed bearings are both mounted on the same axis . . . always stay in alignment. Throat sizes 6" through 48", with the clean, low silhouette progressive industry demands.

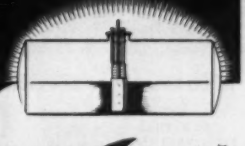
Complete, up-to-the-minute information, sizes, capacities, and prices on all Western equipment upon request. In 1951 SWEETS and A. E. C. **AVAILABLE FROM YOUR FAVORITE WHOLESALER'S STOCK.**

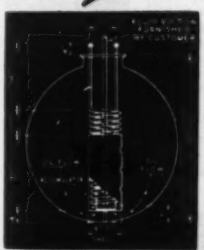
"ALWAYS ON THE JOB — NEVER ON THE PAYROLL"

WESTERN ENGINEERING & MFG. CO.
1726-28 E. WASHINGTON BLVD., LOS ANGELES 21, CALIF.

Solve STORAGE TANK OIL PREHEATING

REMPE "Hot Spot" PREHEATER





All-steel shell and coil assembly for preheating No. 5 and Bunker "C" oils and other liquids to proper flow temperature before they enter the suction pipe. Positive pre-heating by flow accumulator.

Suction pipe, inlet and outlet pipes for heating by steam or hot water go through manhole cover. Made with 14" or 16" diameter shell.

Write for details.

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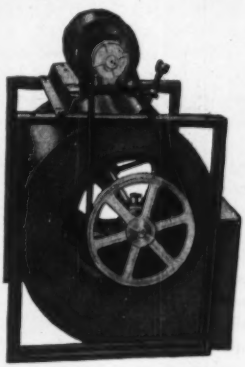

THE *NEW* UNIVERSAL TYPE "N" BLOWER

MASSACHUSETTS . .

By changing the position of the oil cup, the four popular discharges (lower horizontal, upper horizontal, down-blast and up-blast) can be obtained. Sizes 7 to 16½ inches wheel diameter.

WRITE FOR BULLETIN No. 110 CATALOG

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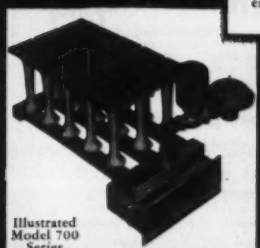
The **BISHOP & BABCOCK** *Mfg. Co.*
4901 HAMILTON AVENUE CLEVELAND 14, OHIO

Exclusive Territory open for Dealers and Manufacturers Representatives

• We have a few choice territories open for dealers and manufacturers representatives to handle the famous line of Reinhard Gas Conversion Burners.

Exclusive features make Reinhard Gas Burners outstanding in performance, economy and quality. Franchise includes merchandising plans, advertising and display material, and cooperative advertising plan.



Illustrated Model 700 Series

THE *Reinhard* GAS CONVERSION BURNER

For Commercial, Industrial and Domestic Installations

•Reinhard Burners are built for converting practically every type of furnace, stove or range.

The patented exclusive features, plus top quality, make them easy to sell . . . No other manufacturer can make this statement—"No burner heads or baffle plates have ever been replaced due to burning out." . . . Write for full details.

THE HOUSE OF REINHARD
725 Second Ave., N.
Minneapolis, Minnesota

"Better Burners Are Made . . . Reinhards Make Them"

APCO *Packaged* CONDENSATION RETURN UNITS

for the SMALL LOW PRESSURE JOBS

10 to 40 lbs. with 8, 15, 30 Gallon Receivers

Packaged Duplex Condensation Return Unit with No. 4 Series Apco Pumps.

Start saving valuable heat units with APCO Square Tank Units. Built to meet demand for a smaller unit with the superb performance of our larger units. Remember, the Pumps are Apcos. No Vapor Binding — Special Provision for Expansion and Contraction — No Frictional Wear within pump. Thus, ECONOMY.

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. . . combined to give you one great service

Hajoca Corporation takes pleasure in announcing it is now handling the complete Dunham line of top quality heating equipment including

Baseboard Radiation	Unit Heaters
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HEATING SYSTEMS AND EQUIPMENT DUNHAM

discharge of condensate through floor drains, etc. According to the moisture removal capacity chart in the pamphlet, the capacity is approximately 19 lb of moisture per 24 hr when the ambient temperature is 80 F and the relative humidity is 90 percent. According to the manufacturer, the unit will dehumidify an enclosed area of tight construction of up to approximately 8000 cu ft volume.

Potentiometers

HPAC 117—A new 36 page catalog (No. 15-15) covering "ElectroniK" electric control potentiometers for both contact and proportional control has been released by the Industrial Div. of Minneapolis-Honeywell Regulator Co., Philadelphia 44. Engineering and constructional data, types of control, partial lists of available ranges, application data, and accessory descriptions are given.

Propeller Fans

HPAC 118—Circulators & Devices Mfg. Corp., 128-168 32nd St., Brooklyn 32, has prepared a new catalog illustrating its complete line of ventilating equipment. Sizes, speeds, capacities, weights, prices and other pertinent data are tabulated for pedestal and desk fans, window fans, exhaust fans (including industrial type belt-drive units) and spray booth fans. Information is also given on both cast iron and steel blowers of the centrifugal type.

Properties of Stainless Tubes and Pipe

HPAC 119—A new handbook on the properties of, and methods of working, seamless and welded tubes and pipe of the stainless "Croloys" is offered by Babcock & Wilcox Tube Co., Beaver Falls, Pa. Intended for engineers, designers and fabricators, it is designed to serve as a guide in choosing the proper material. It describes the tubing steels and covers methods of manufacture and inspection, corrosion and oxidation resistance, and methods of fabrication. Tables of technical data for eight different types of stainless alloys are given, along with a list of applications. This 104 page leather-bound booklet is identified as Technical Bulletin 1B. Request for copies should be forwarded directly to the manufacturer on your company's letterhead.

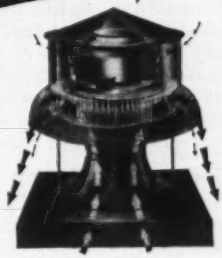
Refrigeration Manual

HPAC 120—The fourth printing of the refrigeration manual published by Copeland Refrigeration Corp., Sidney, Ohio, has been completed. The 40 page booklet is a concise elementary text designed to aid servicemen, salesmen and students. Chapters deal with principles of refrigeration, compressors, condensers, evaporators, refrigerant metering devices, motors, controls, etc. Numerous diagrams are included and tabular data cover boiling points of water and refrigerants, conductivity factors for various insulations, and usage factors for estimating loads.

Speed Reducers

HPAC 121—Dodge Mfg. Corp., Mishawaka, Ind., has released two new bulletins on the selection of its shaft mounted speed reducers. Bulletin A-470 covers the double reduction "Torque-Arm" series available in six sizes for loads up to 25 hp and for output speeds from 13 to 133 rpm. Bulletin A-602B gives data relating to the single reduction series which is available for output speeds from 115 to 330 rpm and in capacities up to 27 hp.

GALLAHER SCROLL EFFECT for TOP EFFICIENCY



GALLAHER AIR-VAN POWER EXHAUSTER

Gallaher Company research proves conclusively that top performance against ⅛" static pressures (and up) with a centrifugal fan is impossible without scroll effect. This is a built-in feature only in the Air-Van power roof exhauster!

This is but one of the many features that puts Air-Vans tops in industry. Others: certified ratings, a unique hood ventilation that forms a positive air seal-off against fumes, low silhouette, economical direct connection, rugged connection and many others!

Pats. 2526290, 2188741

Capacities 150-11,000 CFM; Static Pressures to 1¾"

For full information see your Gallaher representative — or write Dept. H.P., 4108 Dodge St., Omaha 3, Nebr.

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...quiet power

through modern engineering design

STERLING KLOSD MOTORS

Features . . .

...quiet operation—protected construction — streamlined design — cool running — through ventilation — double shielded ball bearings lubricated for life — NEMA dimensions — cross-line starting — liberal connection space—dual voltage — vinol acetal insulated wire in stator windings — molecular welded connections. Available with feet or footless, face or flange mounted, drip-proof or splash-proof.

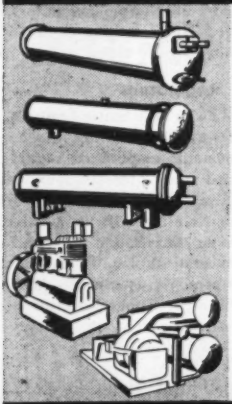
Write for bulletin No. FQ-61.

STERLING ELECTRIC MOTORS

Plants: New York 51, N. Y.; Los Angeles 22, California; Hamilton, Canada; Santiago, Chile. Offices and distributors in all principal cities.

QUICK - PROMPT

RETUBING SERVICE



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FREON - AMMONIA - CO. CONDENSERS AND COOLERS —ANY CAPACITY. STEAM CONDENSERS

BOILERS HEAT EXCHANGERS OR ANYTHING WITH TUBES

Reconditioning and Overhauling Centrifugal and Reciprocating Pumps Centrifugal and Reciprocating Refrigerating Compressors Large Stock Tubes on Hand

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For New Equipment - Write our general office 95 River St., Hoboken, N. J.

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SNOW MELTING

Systems around Buildings and Grounds

Better send at once for our SNOW MELTING MANUAL. Here are design data based on a study of—and others' actual experience with over 100 snow melting systems of all kinds for

- LOADING PLATFORMS and DOCKS
- SIDEWALKS • ROADS • DRIVEWAYS
- MARQUEES • PARKING AREAS
- RUNWAYS • RAILWAY SWITCHES

and other applications which HAVE proved that this modern method of snow removal

Costs No More Than Other Methods

—and because snow melting by pipe coils has other distinct advantages, such as dirt-free sidewalks and entrances, and the complete elimination of ice surfaces, the demand for this method of snow removal is swiftly growing.

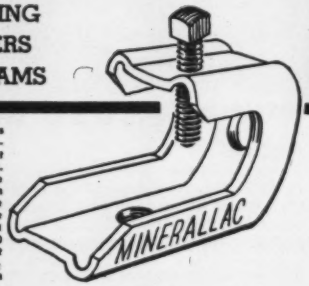
Complete information on the correct design, installation and operation of snow melting systems is offered in the new SNOW MELTING MANUAL, a reprint of articles originally published in HEATING, PIPING & AIR CONDITIONING.

$1.00 will bring you this SNOW MELTING MANUAL . . . a valuable addition to your file on business opportunities.

Heating, Piping & Air Conditioning

6 North Michigan Avenue Chicago 2, Illinois

MINERALLAC
BEAM
CLAMPS
FOR
MOUNTING
HANGERS
ON I-BEAMS



Mounts Minerallac hangers No. 0 to No. 6 on I-Beams safely without necessity of drilling holes. Made of heavy gauge zinc plated steel with deep drawn ribs to give needed strength, these durable, light weight beam clamps have ¼-20 tapped holes—will fit beam flanges up to ½ inch thick. Furnished with case-hardened set screw. Low cost.

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These months offer you an opportunity to do a real selling job on Reznor Gas Unit heaters. People still remember the "bad times" they had with their heating equipment last winter. Summer is the convenient time to install a new Reznor system with its added advantage of summer air circulation. So now's the season to sell your prospects the world's most popular heating machines which have made gas heating history since 1888.

Hung from ceiling or mounted on floor

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31 UNION ST. · MERCER, PENNA.
Send me 20-page catalog in full color

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Firm _____
Address _____
City _____ Zone ____ State _____

Steel Pipe Couplings

HPAC 122—Coupling specification sheet No. 451-C, listing dimensions of line, railroad, merchant, water well, and other pipe couplings, is offered by Capitol Mfg. & Supply Co., Columbus, Ohio. Compiled for easy reference, the specifications follow the recommendations of the American Iron & Steel Institute, the American Petroleum Institute, and the Association of American Railroads.

Synchronous Motor Controls

HPAC 123—Booklet 3100-PRD-204, describing its standard types of polarized field frequency controls (standard interrupting capacity type) for synchronous motors, is available from Electric Machinery Mfg. Co., Minneapolis 13. Included are data on weights and ratings, together with dimension charts, wiring diagrams, and specifications for full voltage, reduced voltage, and part winding controls.

Technical Sound Films

HPAC 124—Some 72 sound films covering general interest subjects, product information, and training and instruction courses are listed in a new sound-film catalog available from Westinghouse Electric Corp., Box 2099, Pittsburgh 30. Divided into three sections, catalog B-4761 describes each film, gives a list of people which the particular film should interest and gives information on film size, projection time, type of film, shipping weight, etc. One of the films listed covers hints on electrical servicing in the air conditioning industry. All films are loaned free to organized groups, with the cost of transportation paid by the borrower.

Temperature Regulators, Thermostats

HPAC 125—According to H-B Instrument Co., 2633 Trenton Ave., Philadelphia 25, its thermo-regulators and thermostats may be selected according to accuracy requirements from plus or minus 0.0005 F to plus or minus 0.10 F. Equipment described in catalog No. 18 includes the company's "Quick-Set" and "Red-Top" thermo- regulators, and the multi-contact thermo-regulators having 3 to 14 operating contacts, as well as more simple types.

Thermostatic Temperature Regulators

HPAC 126—Bulletin S-5 of Lawler Automatic Controls, Inc., 453 N. MacQuesten Parkway, Mt. Vernon, N. Y., covers its line of Type S thermostatic temperature regulators. The unit is a self contained vapor-pressure-operated device for automatically regulating the flow of liquid or steam through a valve. It consists essentially of a valve body, super-structure, a bellows or diaphragm, a connecting capillary tube, and a thermostatic bulb. In addition to design and construction features, information is given on allowable steam working pressures, temperature ranges, available valve seats, dimensions, list prices, etc.

Thread Inserts

HPAC 127—Bulletin No. 650-R of Heli-Coil Corp., 47-23 35th St., Long Island City 1, N. Y., gives design data on helical wire thread inserts and covers the use of these inserts in the protection and repair of tapped holes. Detailed drawings and text explain how these inserts are used to protect threads in aluminum, magnesium, plastics, iron, steel and wood against stripping, wear, corrosion, seizing and galling.

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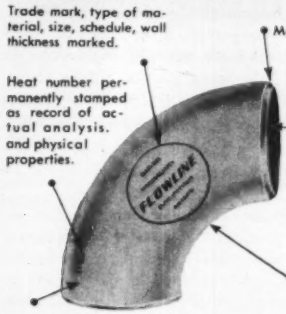
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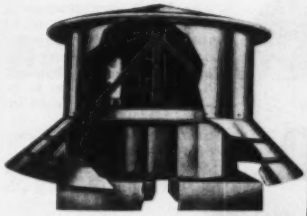

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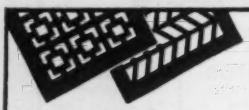

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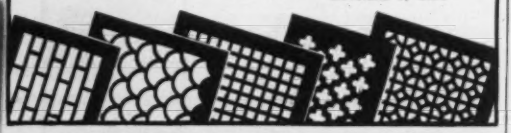

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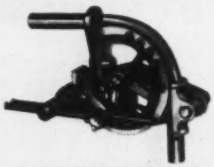

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Tubing for High Temperatures, High Pressures

HPAC 128—Condensed technical information on the design, fabrication and use of tubing in elevated temperature and high pressure applications is contained in a six page bulletin (12F) offered by Babcock & Wilcox Tube Co., Beaver Falls, Pa. Information given covers analyses, physical and mechanical properties, creep strength, short time elevated temperature tensile strength, and oxidation resistance of fourteen of the more popular tubing steels. Also included are data on carbon, intermediate chrome molybdenum and stainless steels used in high temperature, high pressure service.

Viscosity Measurement

HPAC 129—Applications, capacities, and typical installations of the four types of "Viscorator" instruments (for viscosity measurement and control in industrial processes) are outlined and illustrated in Catalog 88, issued by Fischer & Porter Co., 4030 County Line Rd., Hatboro, Pa. The new "Auto Sampling" model utilizes a constant differential pressure regulator designed to provide a constant meter sample flow rate, regardless of line fluctuations.

Water Softeners

HPAC 130—Bulletin 4530, issued by Cochrane Corp., Philadelphia 32, gives details on its hydrogen zeolite (cation exchange) water softeners. This 16 page bulletin describes the process and the field of application, showing the advantages of this type of softening and its relations to the sodium zeolite softening process. The bulletin not only describes the process, but the zeolites themselves and gives detailed information on equipment used.

Water Treatment

HPAC 131—A new folder on the use of organics in water treatment has been issued by Power Chemicals Div., E. F. Drew & Co., Inc., 15 E. 26th St., New York 10. The folder desribes the need for organics in altering the nature of sludge in order to make it nonadherent. It covers the theoretical and practical considerations involved in the use of organics and describes and illustrates the manner in which they overcome sludge problems.

Wrought Iron Pipe for Snow Melting

HPAC 132—A new 36 page booklet prepared by A. M. Byers Co., Clark Bldg., Pittsburgh 22, Pa., describes snow melting applications of the company's wrought iron pipe. The advantages of snow melting are discussed, and typical melting applications for factories, office buildings, highways, etc., are shown. The use of melting systems for frost prevention is emphasized. Pipe requirements are discussed, along with design of melting systems and the factors affecting design (such as temperature drop and use of anti-freeze). Eight piping layouts are given for a variety of installations (such as loading areas, ramps, sidewalks, highways, etc.). Auxiliary equipment is covered and controls appropriate to different size systems are described. Details of paving design and fill, fabrication and installation, and average installation and operating costs are given. 83 illustrations show 50 snow melting systems either operating or being installed.

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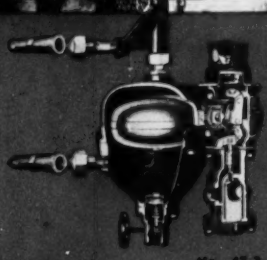
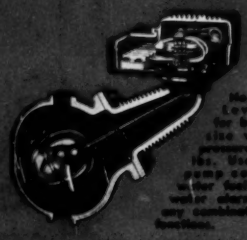


No. 47-2 Feeder-Cut-off Combination for boilers below 5000 sq. ft.; maximum steam pressure, 25 lbs. Quick-Hook-Up for speedy, correct installation.

No. 67 Low Water Cut-off for all automatically fired boilers; maximum steam pressure, 25 lbs.



No. 150 Water Level Control for boilers of any size with steam pressures up to 150 lbs. Used as feed-pump control; low-water fuel cut-off; low water alarm switch, or any combination of these functions.

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Boiler Water Level Controls